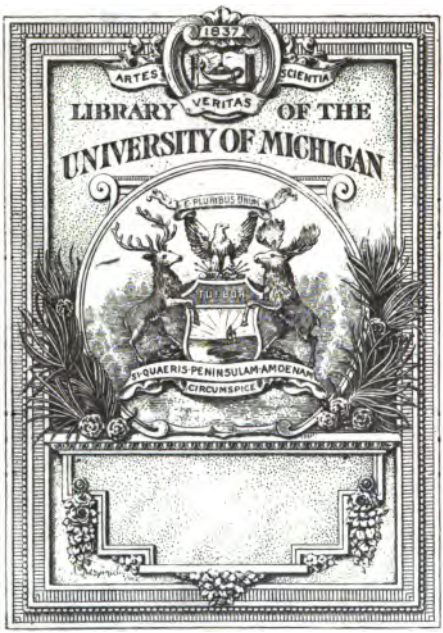
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# FOOD MATERIALS
AND
# THEIR ADULTERATIONS

BY
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# PREFACE TO REVISED EDITION

CONDITIONS have changed with marvelous rapidity in the twenty years since this little book was written, and in no quarter more than in the food problem. The original aim of the author and her collaborators was to arouse women providers for their families to the need of a study of the materials they purchased, both from a sanitary and economic point of view.

If such study was needed then, it is tenfold more important now, since, while the women have slept, the manufacturer has kept wide awake and has employed the chemist to help him impose upon the ignorant and credulous housekeeper.

With the establishment of state and city laboratories there is not today the need of the Housekeepers' Laboratory which the authors tried to introduce. Nearly every householder can find the information that she needs by a visit to one of these laboratories if not in the printed reports. To take an instance from a burning subject at this writing: Since 1896, when the Massachusetts State Board of Health first published a list of patent medicines containing alcohol, there has been no excuse for any citizen of the state to be deceived. Common sense would have told him that such a practice once started would go on and other names would cover similar compounds. Housekeepers should make use of the information which is paid for by their taxes.

It is to ring again the call to study facts and conditions that the author and her coadjutors have decided to revise this little volume, which has been out of print for some time.

They are unable to understand the slowness of young women to take up the study of chemistry after they have made it possible and have shown the practical advantage of such knowledge.

Doubtless some such universal excitement as the country has just been through is needed to focus attention. All this agitation over the pure food law has come about because the buyer has not kept himself informed as to the methods of manufacture, and because the impossible has been demanded. We are all suffering because thoughtless and ignorant women have demanded *red* berries, *green* pickles, bright catsup, and variegated candies, and have not even considered whether the results were possible without preservatives and coal tar dyes. It is, perhaps, an evidence of the ancient credulity persisting in the belief that science can work miracles. But it was to combat that idea with knowledge that this volume was written and is now rewritten. It seems incredible that intelligent women could have put upon their tables canned meats "largely corn meal" and not know the difference.

To the housewife and mother we say: For the sake of your children keep yourselves informed of the true state of the food manufacture. Do not accept all sensational headlines, but yourself study and give your daughters an opportunity to study chemistry in the high school. Encourage your grocer to provide honest goods. It will take time and thought, but on what can these be better spent than on that which gives health and vigor for the better enjoyment of all the good things of life?

BOSTON, July, 1906.

## PREFACE TO FIRST EDITION

THERE is neither novelty in the information which this little volume seeks to convey, nor originality in the manner of presenting it; but when its preparation was begun, some years since, the facts here considered were for the most part found scattered through large and costly technical works, written for the conditions existing in England and Germany. The books claiming to be popular expositions were either so old as to be out of date, were sensational, or otherwise unsatisfactory.

One excellent English work has recently appeared which is so suitable and admirable in form, as well as in material, that at the first glance it seemed superfluous to issue the present one. Yet Church's "Food" was prepared especially for the visitors to the Bethnal Green branch of the South Kensington Museum, London, while the place which this little volume is intended to fill is that of giving useful information in a form available and attractive for schools and for home reading without technicalities or unnecessary details. It has been compiled from many sources, and it would be impossible to credit each book with the special facts derived from it, since the same thing in different forms is often found in several works. Quotation marks are intended to indicate all passages taken verbatim. The names of the books consulted will be found in the list at the end of the volume. It is in the hope that these works may be more widely known, and the subjects of which they treat more earnestly studied, that this slight contribution is sent forth.

The conclusions are a result of ten years' experience in laboratory examination of food materials.

The author is especially indebted to MISS S. MINNS and to MISS L. M. PEABODY for valuable aid, both in the laboratory and in the preparation of the text.

BOSTON, December, 1885.

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# FOOD MATERIALS AND THEIR ADULTERATIONS

## CHAPTER I

### PRINCIPLES OF DIET

THE food of savage and semi-civilized man has always been of the material most readily obtained; either the flesh of animals killed in the chase, or wild fruits native to his country, or the products of crude agriculture.[1] The nations of Northern Europe, down to nearly the middle of the present century, ate rye and barley bread, as wheat could not be profitably grown in that region; and the Esquimaux today live upon the product of the seal fishery from necessity, not from choice.

Now, the food products of the whole world are accessible to the people of the United States through the use of improved methods of transportation — the refrigerator car and steamship compartment — and through improved methods of preservation — by cold storage and by the canning process.

This very abundance brings its own danger, for the appetite is no longer a sufficient guide to the selection of food, as it was in the case of the early peoples, who were not tempted by so great a variety.

No hard and fast rule of what to eat can be laid

[1] For the diet of ancient peoples, see Food and Dietetics, Pavy, p. 475.

down. Not only is it true that what is meat to one is poison to another, but it is also true that what a man may eat with impunity today may cause illness tomorrow, because the man himself is in a different condition. After a day spent in pleasurable exercise in the open air one may take a meal which might jeopardize his life if taken after a day of grief, anxiety, or exposure to severe cold.

Bodily energy is supplied by the food which has been "assimilated," made a part of the body tissues. Much food eaten is never so utilized. It passes through only slightly changed or is decomposed into toxic substances that do the body harm and not good. Illnesses which come from this cause are said to be due to auto-infection.

Many diseases of modern civilization are doubtless due to errors of diet, which might easily be avoided. Numerous dietaries have been published, but nearly all are only of limited local application, so that when applied elsewhere they have failed and brought discredit upon the whole plan. Only certain broad principles can be laid down, and much intelligent study must be brought to bear upon the question in each community.[1]

The first general principle is suggested by Dr. Pavy, when he calls attention to the fact that the meat eaters among animals, having to hunt for their food, pass long intervals without any, and when it is obtained gorge themselves with it, and then lie torpid for days. The herbivorous animals, having their food always near them, eat all the time, and are stupid all the time.

[1] F. G. Benedict: Journal of Physiology.

Man ought not to imitate either class. It is his privilege to choose such times for eating and such materials for food as will best develop his mental power. Many writers seem to forget this, and to plan man's food as if he were a mere animal, whereas he is or may be very much more. His food should be such as to keep the animal mechanism in good order for the mind to use. It should not be overfed, so as to be sluggish, nor should it be starved, so as to be incapable of executing the mind's demands.

Food should be eaten for bodily profit and not for pleasure only. The two should be combined in a correct diet.

While the whimsicalities of the sitophobist should be avoided and the stomach allowed to do its work unwatched, yet each one should take pains to acquire right habits in eating, as in walking or speaking. The physician knows that a large part of man's ills comes from his persisting in *bad* habits of eating and from his dense ignorance of food and its effect on him.

Life is too valuable a possession to be at the mercy of mere whims, and it is an economy of expensive material to make the food tell in an efficient life. Further discussion of these points belongs elsewhere. In this volume one side of the food question only is presented.

# CHAPTER II

## THE RELATION OF GENERAL INTELLIGENCE TO THE QUALITY OF THE FOOD SUPPLY

THE prosperity of a nation depends upon the health and the morals of its citizens; and the health and the morals of a people depend mainly upon the food they eat and the homes they live in.

Strong men and women cannot be "raised" on insufficient food. Good-tempered, temperate, highly moral men cannot be expected from a race which eats badly cooked food, irritating to the digestive organs and unsatisfying to the appetite. Wholesome and palatable food is the first step in good morals, and is conducive to ability in business, skill in trade, and healthy tone in literature.

This being granted, what office is of more importance to the State than that of the provider of food for the families composing it? The modern stock farm has given us most of the scientific knowledge we possess on the question of foods. All this because it pays to know the composition of the food and its effect on the value of the stock. Shall the human animal be considered of less consequence?

The agricultural states of the Union have recognized the two fundamental professions upon which their prosperity rests, and have established in their agricultural

colleges a parallel course of domestic economy to complete the education of the girls.

This is an instance of wisdom, an example which might be more widely followed, for in all our towns and villages the housewives need to know something of the materials of daily consumption.

The conditions of life have changed here in New England so rapidly and completely that our young housewives find themselves very much at a loss. The methods of their mothers and grandmothers will no longer answer. *They* had no trouble with their soap, for they superintended its making and knew its properties. *They* knew how colored fabrics should be washed, for they had the coloring done under their own eyes. *We* buy everything, and have no idea of the processes by which the articles are produced, and have no means of knowing beforehand what the quality may be. Relatively, we are in a state of barbarous ignorance, as compared with our grandmothers, about the common articles of daily use.

The only remedy is for our girls to learn something practical about these forces and the nature of the materials which are scattered about so freely. The distinction between an educated cook and an uneducated one of the same skill is that the educated one can tell some one else just how and why she takes each step, while the uneducated one can do the thing, but cannot tell any one else how or why she does it. Let our schoolgirls bear this in mind, and so study their chemistry and physics that they can tell why this and that should or should not be done. A little actual

knowledge wonderfully simplifies things, and adds interest to the commonest deeds.

Educated women must mark out a new plan for themselves. Our girls must be taught to recognize the profession of housekeeping as one of the highest, although not necessarily the only one; but, whatever art or accomplishment they may acquire besides, let them consider that the management of a household is not to be neglected. The properly educated housekeeper is not a drudge; she has all the forces of nature at her command — the lightning harnessed to give her light; the stored-up energy of past ages at her command by the turning of a stopcock; swift steamships and railways bring to her fruits and vegetables from all climes; the vast prairies furnish meat, game, and flour; mechanical skill gives her all kinds of labor-saving devices; the general prosperity and improving taste of the country admit of tasteful decoration of the rooms. Surely, never did housekeeping present so many charms. Alas! the winged Pegasus is too strong for his unskilled rider, for in his train has come a style of living both extravagant and demoralizing. All this delicate machinery and costly luxury are committed by ignorant mistresses to still more ignorant servants — conservative by inheritance and superstitious by nature, restless with the very air of the new and to them wonderful country, where all men are equal, and naturally bewildered by the novelties of the new life, so different from their simple one. What wonder that the complicated machinery comes to grief, and the tempers of both mistress and maid are spoiled in attempting the impossible!

Within the memory of the present generation there has crept into the heads of the great American people a most pernicious and insidious idea — that labor with the hands alone is degrading and beneath the dignity of a free American citizen. Nowhere has this been more noticeable than in the place to which housework has been relegated.

To judge by the opinion of the average schoolgirl, one would think that housekeeping required no more thought than the breaking of stones on the highway. Such may listen with profit to Ruskin when he says: "It is a no less fatal error to despise labor when regulated by intellect than to value it for its own sake. In these days we are always trying to separate the two. We want one man to be always thinking, another to be always working; and we call the one a gentleman and the other an operative, whereas the workman ought often to be thinking and the thinker to be working, and both should be gentlemen in the best sense. Now, it is only by labor that thought can be made healthy, and only by thought that labor can be made happy."

If this is assented to, then is not the conclusion clear that if our girls were capable of *thinking* about the many problems of housework and of investigating new and better ways they would find the work an interesting and worthy one?

Just now educators are complaining of all classes of students, saying that they are too careless or too indolent to think for themselves, that they wish their knowledge, like their food, "predigested." Women of sense ought not to shirk a little exercise of their minds.

Political economists are beginning to take up this subject, for they see that the ultimate welfare of the country depends upon securing the maximum of utility for the money spent. The money's worth must be obtained from both material and labor. The law of utility requires an adequate return for the value consumed. A loaf of bread eaten by a farm hand returns more than its value in the produce of that man's labor; so it should be with all labor, whether mechanical or literary. A loaf of bread allowed to mold brings no return in wheat or in useful thought, and it is therefore wasted — so much value thrown away. So, too, if a family consume at one meal three times as much food as is needed to keep them in perfect health, the excess is wasted, and sometimes worse, in that it causes disease. Not that a family which can afford beef should live on corn meal, but that if the food is not wisely used for pleasure or nourishment it is wasted.

It is believed by many that instruction in the fundamental laws of hygiene and of efficient living should begin in the elementary school and continue through and beyond the college.

The following statement was unanimously adopted as the sentiment of the Lake Placid Conference in 1902:[1]

"The Lake Placid Conference on Home Economics considers that the time has come when subjects related to the home and its interests should have larger recognition in our colleges and universities.

[1] Proceedings of Lake Placid Conference on Home Economics, 1904.

"Recognizing the fact that there is a strong and steadily increasing demand for knowledge of these subjects, believing that their educational possibilities are not inferior to those of other subjects now in the curriculum, and that instruction in these branches promotes in a high degree individual and social efficiency, we earnestly request that the heads of our higher institutions consider the advisability of introducing such work. This may be done either by the establishment of new departments or by the extension of courses already offered.

"History, sociology, and economics deal with fundamental problems of the family and the home. Biology, chemistry, and physics have important applications in the household. This has been already recognized to some extent by leading universities, and their curriculums include such courses as 'The Family,' 'The Citizen or Householder,' 'The Evolution of the House,' 'Sanitary Chemistry,' 'Food and Nutrition,' 'Bacteriology,' besides work in sanitation, physiology, and hygiene.

"The members of this conference believe that an extension of such work where it is already established and its introduction in other institutions would contribute to the solution of some of the most important social problems of today."

One of the most puzzling problems which a modern housewife has to solve is to learn the quality of the various food materials which she provides for the use of the family, and to know how to apportion them. So much has been said on the subject of adulteration

in the past few years that the peace of mind of a conscientious woman is quite gone.

A government report on baking powder, made some years ago, argues that the "housewife surely deserves protection against swindling as much as the farmer (for whom the government will make analyses of fertilizers), and she has no better means of ascertaining the strength and quality of the baking powder she buys than the farmer has for the strength of his fertilizer. The verity and accuracy of the analysis stated on the label should be insured, as in the case of the fertilizer, by its being performed by a sworn analyst. If such a regulation were enforced, people would soon inform themselves of the respective merits of the different varieties, and the further requirements of a certain standard of strength, as suggested by Professor Cornwall, would probably be unnecessary, as they would learn to interpret the analysis, and a powder made up of fifty per cent of starch, for instance, would have to be sold cheaper than one made with ten per cent, or not sold at all."[1]

Reference is made several times in these pages to the sources of reliable information, and here emphasis is laid on the fact that many of the alarming statements, so disquieting to anxious mothers, are inserted in the circulars sown broadcast and in newspaper advertisements by one manufacturer to decry another's product and to promote the sale of his own. Sometimes these are not exactly falsehoods, but they may easily be interpreted in a false way.

[1] Quoted in Bulletin of the Kansas State Board of Health, March, 1906.

If the buyer used a little of that thinking power for which we have been pleading he or she would not be deceived. The boldness with which misleading statements are printed leads to the inevitable conviction that buyers will not take the trouble to think or to find out from the city and state authorities what is true. Instead of taking the sensible course the average woman believes every sensational article that she reads, and does almost as much harm to her family by avoiding a good article as by purchasing an inferior one.

The unanimous testimony of all chemists who have carefully investigated the extent to which adulteration of food is carried on in the United States is that, while there exists adulteration injurious to health, there is a much greater injury to the morals of the community and loss to the pockets of the people. In other words, the point to which public attention should be mainly directed is the question of paying a high price for an inferior article. In some portions of the country ground gypsum — at perhaps a cent a pound — is sold for cream of tartar at ten cents a quarter of a pound. Now this fraud can be detected by any one who knows that cream of tartar is soluble in hot water, while gypsum is not. A cupful of boiling water poured upon half a teaspoonful of good cream of tartar will dissolve it almost instantly, giving a nearly transparent liquid.

In these days of wandering attention "scare heads" alone fix themselves on the public mind. So it has come about that the word "adulteration" looms large in the estimation of even thoughtful persons, who pass by the really important matter of nutritive value and

of combination. Yet the number of deaths caused by adulteration is infinitesimal compared with the number caused by auto-infection (from diseases arising within the body) and by personal indiscretion in diet.

If the present interest in the misdemeanors of the manufacturers shall focus attention on the importance of food to human welfare it will have served a good purpose.

A long acquaintance with the markets of the country in the East and West, North and South, leads the author to the estimate that not over two per cent of the total weight of the food sold in shops and markets is adulterated, and that not more than an additional three per cent is sophisticated — that is, lowered in commercial value by a cheaper ingredient.

What proportion of the whole bulk of the family food is made up by the few ounces of spices, condiments, and fruit essence? What if the color of the occasional pink tea or green dinner is aniline dye! One-sixteenth of an ounce is probably a large estimate of the amount used by any one person in a year.

The extra twenty per cent of starch in a box of baking powder, if a family uses ten pounds a year, levies a tax of only sixty to eighty cents, or twelve to sixteen cents a person. How many times that amount do all today waste on candy and *soda?* The damage to health by the injudicious drinking of soda and various "bottled beverages" is many times that caused by all the preservatives used in food.

It is, however, true that "the use of preservatives, usually salicylic acid or benzoate of soda, is very com-

mon in the manufacture of fruit syrups and that coal tar dyes are freely used to give an attractive color.

"The grape juices have usually been found pure, but in some instances from five to seven per cent of alcohol has been found.

"All lime juices are much below standard, having been diluted with two or three times their volume of water."[1]

It has been the history of every harmful adulteration that, as soon as the public became aware of the nature of it, its manufacture was stopped and some new device substituted. The remedy, then, for this sort of fraud is the education of the general public to such an extent that it can, with some degree of probability, detect any flagrant case of adulteration or substitution. It is the aim of this little book to place in the hands of housekeepers such information as will enable them to purchase intelligently and to know in what direction to be suspicious of the different food products on the market. The nature of the adulterations will vary from year to year with the advance of knowledge and with the detection and exposure of the accustomed frauds; therefore a careful watch is needed to keep the dealers and manufacturers in check. The bulletins of each state agricultural experiment station give the results of examination of local markets.

Demand is the great cause of supply; and if many of the reasons for complaint were examined, it would be found that the grocers, of whom we so bitterly complain, are only supplying the demand of their cus-

[1] New Hampshire Sanitary Bulletin, October, 1904, p. 70.

tomers. Few dealers are in a position to instruct their customers; there are occasional philanthropists among them, but most of them must make money, and they can do this only by supplying what the public want. The superstition yet lingering in the minds of people is nowhere shown more clearly than in the purchases they make for every-day use.

Science, and especially chemical science, has achieved so many marvelous triumphs within the last fifty years that it is looked upon as an occult knowledge, having the power which was attributed to the alchemy of the Middle Ages; and even intelligent persons, perhaps unconsciously, look upon chemical operations as capable of transforming substances in as subtle a manner as was claimed to be possible by the old-time searcher after the philosopher's stone. As a result, the average housekeeper is a fit subject for the modern alchemist — the man who can turn cereals and apple cores into gold by a few neatly turned phrases calculated to impress the housewife with the profound wisdom of the manufacturer.

"Although the words 'adulteration' and 'sophistication' are in a degree synonymous, yet there is a distinction which seems borne out in legal practice. To adulterate the coin of the realm or the liquor of the bar with a baser metal or an imitation whisky is a heinous offense. So is the mixture of milk with the baser article, water, which thereby lowers its food value. But the 'wretched sophistry' which obscures the nature of things on a package of prepared food misleads more persons and inflicts more injury on the community

than the other, yet goes unrebuked. The most barefaced assertions are printed in magazines, and 'pure food shows' only whet the appetite for something new."[1]

In considering the probabilities of adulteration, one important fact must not be overlooked. When prices are low and food is plentiful there is much less reason for admixture of foreign substances; but when prices are high and any article scarce, then is adulteration rife. Take, for example, cream of tartar: in ordinary years, when money is plentiful and gold at par, it can be bought at from thirty-five to forty cents a pound; but when gold was two dollars or more, as during the Civil War, and when the risk of importation became considerable, cream of tartar sold for two dollars or so a pound. The poor people could not pay fifty cents for what they had been accustomed to get for ten, but they did not know enough of the principles of cooking to get along without it, and so they asked for something cheaper. During those years there was very little of the genuine article sold under the name, and the result was poor bread and injured health.

A very good example of the law of supply and demand was given to the writer by a man of strict integrity, but a man of business who understood the public temper. When quite young he kept a small grocery store in one of the suburbs of Boston. Cream of tartar had just come into use. A woman who had been in the habit of purchasing her supplies at a neighboring grocery came to him one day for some articles.

[1] Air, Water, and Food, p. 155.

The young man prided himself on the good quality of his goods, therefore felt quite sure she would be pleased and give him her custom. What was his surprise to have her come back and complain of the quality of his cream of tartar. It did not make as good bread as that which she had been buying. He ventured to suggest that perhaps it was strong and that she used too much; but she would not be satisfied and wanted another kind, so he made up a package for her of two-thirds cream of tartar and one-third rice flour; this satisfied her, and she became his customer. We can hardly expect our grocers to become philanthropists and teachers of the people. Their business is to supply the public with the articles which it demands, and it is from education of the public that we must look for redress. There is great danger to the moral sense of the community from this sort of cheating — this obtaining money under false pretences (for it is nothing else). And the public is content to be cheated; it should be aroused, and by a knowledge of food materials a stop may be put to most frauds.

In the new enthusiasm for social service many students are working at the problem of developing a fuller life for the sinews of the republic, the wage-earners. Each one of these students of social conditions comes upon a find, as it seems to him, of a great leak in the average family purse in the case of his grocer's and butcher's bills. By all laws of economy the workman should not spend so much of his money for food. If he lived more economically his family could have more recreation and a better house.

There is no more burning question in sociology today than this, What ought food to cost? That the buyer does not get his money's worth in many directions is true. It is to add one mite to the heap of knowledge which the United States Government is sending out in its bulletins from the Department of Agriculture that this volume is written.

One result of this study of social conditions is the introduction of cooking into the public schools and, along with the practice, a considerable amount of elementary science to serve as a foundation for further study and an inspiration to investigation. Helpful as these classes have been, they are still often too much under the domination of the commercial cooking schools, as we may term them — those which depend upon the patronage of women who wish to outdo their neighbors in fancy cakes, pink teas, and decorative rather than nutritious dishes. In the one case food is used, like fabrics and flowers, as decoration and not as that strength-giving material which shall make men and women workers.

The cooking classes of today must learn how to make attractive meals out of nutritious materials, and must pay attention to composition and quantity of food served as well as to its outward appearance.

A great deal may be done by economy in the preparation of food and in the substitution of one kind for another, according to the cost at different seasons of the year. Here a knowledge of the composition of the various articles of diet will enable one to choose and yet to give the family all the constituents needed.

Tables[1] of the relative value of foods will guide a wise housekeeper in her selection.

Another instance of the disinclination to think is seen in the multiplication of cook books which give recipes rather than principles upon which variations may be made.

The modern housewife seems helpless before a new material, utterly at a loss how to combine old materials into new dishes, and therefore wastes good food.

However, the agitation of the subject of diet in its relation to health is calling attention to the importance of so vital an element in human existence, and much progress may be looked for in the immediate future.

Undoubtedly it will need two generations of sound teaching before bad habits in eating and drinking will be conquered and sane, sensible methods be common.

Of all the dangers to health from eating, that of unclean food leads all the rest. This uncleanness is due to unsanitary production, feeding, and transportation of animals; careless use of fertilizer on vegetables; cold storage under bad conditions, both in bulk and in domestic refrigerators; exposure to street dust; and cooking and serving in unclean vessels.

These conditions result not only in actual disease, but in lowered vitality and lessened work power. Probably not more than twenty-five per cent of the inhabitants of any community are doing a full day's work, such as they would be capable of if they were in perfect health. This adds to the length of the school

[1] Bulletin 28, United States Department of Agriculture, Office of Experiment Station.

course, to the cost of production in all directions, to increased taxation, to decreased interest in life. Therefore we say that the safety of food materials lies mainly in the cleanly ways in which they are gathered, kept, and prepared for the table.

For instance, berries may be picked by dirty hands, exposed on dirty sidewalks, covered with dust from the streets, served without suitable picking over and washing. Ice may be cut from polluted water, dragged over sputum-covered sidewalks, and put into the ice box unwashed.

In every direction careless handling of substances used in connection with food seems to have increased, and this in spite of the public dissemination of the germ theory of diseases.

The watchword of every householder should be clean, *clean*, CLEAN, chemically and bacterially clean.

As usual, public attention is aroused to the various concomitant evils without touching the core of the whole matter — personal efficiency through good food habits.

It is well, of course, to stop all the little leaks, but the waste at the bung hole should not be neglected. The renewed excitement in regard to food may be turned to good account in showing the essential value of food to the individual and to the community.

# CHAPTER III

## WATER, TEA, COFFEE, COCOA

IN importance to health second only to pure air is the quality of the water drunk. It may even be considered as a food, for there is at least a probability that its office in the system is more than that of a regulator of temperature and a diluent of the blood. From a sanitary point of view, next in importance to the quality of the water used is that of the other liquids which are more and more frequently substituted for it, namely, tea, coffee, and cocoa. Beer and wine are neither foods nor necessary beverages in this land of good water and cheap coffee, hence they are not here considered.

### WATER

By far the largest quantity of any one thing taken into the system through the mouth is water. The average person drinks whatever is most convenient, yet only in the large cities with a carefully guarded water supply is this safe. In the country nine-tenths of the wells are more or less contaminated and are growing worse.

It is past comprehension that men with some knowledge of soil drainage and water flow should place a well close by the cesspool and kitchen sink and expect it to keep sweet and clean.

Even women with no especial training should have reason enough to know that slops thrown close to the mouth of the well disappear into the ground and must find their way to the water. It seems to be assumed that all clear, cold water comes from a great depth and is therefore pure. Only in the case of driven wells, where a small pipe is driven down to a known distance, or in the case of the true artesian wells, which deliver water in great force without pumping, is this true. The ordinary shallow well, thirty feet or so deep, is usually fed, in whole or in part, from near-by sources and is always an object of suspicion. Such water, unless tested by a reliable expert, should be boiled before drinking, as should water taken from rivers and small streams.

Protection is best secured by cooperation and the introduction of a safe supply for the community, instead of each one depending on his own well or cistern. These are often sources of danger.

But the housewife will ask, "Is not the use of filters better than depending on boiled water?" A coarse filter will take out coarse material such as comes from heavy rains, from growths of *algæ*, from rusting pipes, etc, but it requires porous porcelain or sandstone to take out excessively fine material such as bacteria. This means very slow action and soon a clogged surface. Rapid filters are all merely strainers. A flannel bag tied on the faucet and washed every day will serve for this as well as any expensive mechanical device. The bone black filters will take out color, but color is not the dangerous factor, and the water is rendered

harder by the lime phosphate. All strainers collect the insoluble material that they remove and should be thoroughly cleaned, else they are worse than nothing. All *true filters* act slowly and deliver a small quantity in an hour.

It is worth noting that the New Hampshire State Board of Health in its July Bulletin, 1906, gives an illustration of a household filter, with full directions for construction and use, which has considerable merit; but, like all good things, "it demands intelligent supervision, and the occasional attention prompted by a proper understanding of what it is and what it ought to do from day to day."

The author wishes to impress upon her readers, even to their weariness, that the best things are not obtained by machinery. Very few things are really automatic. Somewhere there must be a *mind* in control, a watchful eye to see the beginnings of failure to work. Let the housekeeper once again learn the pleasure of power over things, of knowledge of constituents and durability, feel once more the delight of invention, and see the work of her mind as well as of her hands grow before her eyes.

A serious danger to the public lies in impure wells on dairy farms. Milk cans washed in foul water have often been a source of disease. On the other hand, the practice of using the well as an ice box cannot be too strongly reprehended.

The first essential in establishing a new home is, then, clean, safe water. The services of an expert must be secured if there is doubt. Towns and villages are

beginning to appreciate the fact that property is worth more where this satisfaction may be felt.

One simple, popular test which may serve to detect harmful materials in water is as follows: Place a pint of clear *well* or *spring* water in a clean, white, uncracked dish on the stove. If, on evaporation, the water leaves dark rings on the dish, or a dark sediment in the bottom, there is positive evidence of danger. If, on the other hand, there is no sediment, we have no *proof* that the water is safe. This test does not apply to surface waters, which always contain harmless organic matter.

### TEA

In regard to tea and coffee more than to any other class of foods is there a popular misconception of the differences in quality, caused solely by methods of preparation, but often attributed to adulteration. Therefore space is here given to the principles of obtaining satisfactory results in the home.

The tea plant, *Thea Sinensis*, or *Camellia Thea*, an evergreen, is a native of China, Japan, and the north of Eastern India, and has been there cultivated from time immemorial. The finest tea of China is grown between the twenty-seventh and thirty-first parallels of north latitude But the plant will flourish from the equator to forty degrees north latitude.

Tea has been used as a beverage by the Chinese for ages past. Tradition refers to it as early as the third century. It first became known to Europeans about the end of the sixteenth century. Until the middle of the seventeenth, the price was from twenty-five to fifty dollars a pound; and a remarkable feature

in its history is the reduction which has taken place in its commercial value, tea now being sold at Canton at from fifteen to twenty cents a pound, and in this country at from twenty-five cents to one dollar. Tea is used at present by about one-third of the human race. The consumption in Great Britain in 1835 was less than one and a half pounds a head. In 1877 it was four and a half pounds, and in 1904 six pounds. In the United States in 1876 it was one and a half pounds. In 1904 it was about one and a quarter pounds. Among European nations tea is preeminently an English, Russian, and Dutch drink.

The quality of tea depends upon its flavor, which should be delicate and yet full; and this is affected by the time of gathering (whether or not the first of the four yearly gatherings), by the age of the tree, by the country in which it is grown, by the quality of the soil, and by the situation of the plantation. The two classes of tea, the black and the green, are produced in the same region and often from the same trees. Green tea is rolled and dried very quickly, the whole process being finished in an hour or two, so that the leaf keeps its color. The idea that green tea is obtained by drying the leaves in copper pans is a popular error, which has been persisted in for a long time, without a shadow of truth for its foundation. For black tea, the leaves are beaten and exposed to the air for some time, so that a sort of fermentation sets in. The production of the aromatic flavors is due to the processes of drying, since the leaves when freshly plucked have neither the odor nor flavor of the dried leaves. Hence different

qualities of tea may be made from the same leaves, according to the treatment while drying. This is the source of the various kinds found in the market under the names Hyson, Oolong, etc. Some teas are scented with fragrant leaves and flowers.

Substitutes for tea are found in nearly every country. Sage leaves were frequently so used in England a century ago. Labrador tea was prepared by the native American tribes. The leaves of thirty-two plants are known to have been thus used.

The important constituent of tea is an alkaloid called *theine*. It is present in varying proportions, from 1 to 4 per cent. The theine is supposed to be in combination with tannin, which is the most abundant soluble substance in tea, usually from 16 to 27 per cent. To the tannin is due the constipating effect of tea. The longer the tea leaves are steeped, the more tannin the solution contains. Regard for the lining of one's stomach would lead one to avoid all steeped teas. The infusion should be prepared immediately before drinking, or removed from contact with the leaves.

The odor and flavor of tea are due to an essential oil which is present in very small quantity, and which is developed during the fermenting and drying. For a good tea the volatile oil must not escape. To make a good pot of tea, scald out the pot with boiling hot soft water, place the tea in it as soon as possible, pour over it the boiling water, and close the pot immediately; allow it to stand in a hot place for a few minutes, but do not let it boil; if the tea leaves are put in a bag or ball they may be at once withdrawn. Tea

as drunk in China is always taken clear, without any addition of milk or sugar. The Russians add a few drops of lemon.

Lo-Yu, a learned Chinese who lived about 700 A.D., says of the effect of an infusion of tea, that it tempers the spirits and harmonizes the mind, dispels lassitude and relieves fatigue, awakens thought and prevents drowsiness, lightens or refreshes the body, and clears the perceptive faculties. Modern writers claim that tea excites the brain to increased activity, while it soothes and stills the vascular system; hence its use in inflammatory diseases and as a cure for headache. Taken in excess it has the effect of a vegetable poison. It affects different people differently, and when it causes nervous excitement its use should be avoided. The infusion is stimulating and not nutritive; hence the use of tea and toast, so common among the workingwomen of America, is very poor economy, and is an evil, one had almost said, second only to the use of alcohol. Indeed, it has been called the tobacco of women; for while the tea does undoubtedly allow one to live on less food, it does not supply the place of food for any length of time. If the exhausted leaves were eaten after the infusion was drunk, as is the case in several countries, it would be more economical, since they contain about 20 per cent of nitrogenous matter, insoluble in water. On the coast of South America and on the slopes of the Himalayas the spent leaves are handed round among the company, sometimes on a silver salver, and much relished. In some places the leaves are powdered and mixed with various nutritious substances, anp eaten without infusion.

According to the best authorities tea should not be drunk as a beverage by persons under middle age, as it is liable to interfere with the development of the nervous system. But for elderly and delicate people whose stomachs are incapable of digesting much food the use of tea is often valuable, as it, like coffee, prevents the waste of tissue, or, in other words, a person requires less food when tea is taken; but it should not be used for this purpose by working people, since it tells upon the digestive power of the stomach, and nothing can supply day after day the lack of nutritious food. Physicians now recognize a tea dyspepsia, and no one with a hope for better digestion should drink tea constantly three times a day.

### ADULTERATIONS OF TEA

When tea was ten dollars a pound there was great temptation to mix other leaves with the genuine, or even to substitute them entirely; also to add to the weight by iron filings, etc, or sand gummed on plumbago and soapstone; the exhausted leaves were also used. Since the price has fallen, very much less adulteration is practiced. It will not pay to work over the tea leaves to any extent, yet they are occasionally adulterated, and inferior grades due to carelessness in preparation and to less careful cultivation are often found.

The most common method of adulteration is by "facing," that is, by treating with certain coloring materials to give intensity to the color of the leaves. The facings in most general use are Prussian blue,

indigo, plumbago, and turmeric, often accompanied by such minerals as gypsum and soapstone. According to Leach[1] the Chinese and Japanese face only the teas intended for export trade.

The addition of mineral matter may be detected by burning a weighed quantity — one gram or more — in a platinum dish, and weighing the ash. Good tea gives from 5 to 7 per cent of ash. If the leaves are exhausted, the per cent will be less. To ascertain the strength of the tea, an infusion is the best test. If the decoction is very high-colored, the tea has probably been doctored. If there is not much extract, the leaves have been exhausted. The surest test of this is the specific gravity of the solution; but even this is a delicate test, since the specific gravity of a solution of 200 grains of tea in 2,000 grains of water is from 1.012 to 1.014, while that of exhausted leaves is from 1.003 to 1.0057. Good tea should yield 26 per cent, and often as much as 36 per cent, of its weight to boiling water.

Spent or exhausted leaves, leaves that have been once steeped and afterwards again rolled and dried, have been used as an adulterant, though the practice is now rare.

Certain foreign leaves, as the leaves of the willow, elder, rose, elm, etc, have been said to be used as adulterants.

Stems, fragments, and tea dust are sometimes found in large proportion.

"As a matter of fact, the worst forms of tea adulteration, such as the actual substitution of foreign

[1]Food Inspection and Analysis, p. 285.

leaves, once so commonly practiced, are now extremely rare in this country and have been for some years, by reason of the careful system of government inspection in force at the various ports of entry. The greater portion of the tea on our market today is genuine, but fraud is practiced to a considerable extent by the substitution of inferior grades for those of good quality. This form of deception is in many cases beyond the power of the analyst to detect, and properly comes within the realm of the professional tea taster."[1]

Tea tablets are made of finely ground tea pressed together, and are prepared for a beverage by simply dissolving in hot water.

The analysis of the Samovar Tea Tablets, according to the Massachusetts State Board of Health, is as follows:

| | |
|---|---|
| Water | 8.7 |
| Theine | 2.25 |
| Extract | 54.4 |
| Ash | 5.4 |
| Soluble ash | 2.8 |
| Insoluble ash | 2.6 |

In England all tea is sampled and inspected, and in 1879, of 575 specimens examined, only three were found to require special disposal — one damaged by water, one consisting of exhausted leaves, and one sanded.[2]

[1] Leach, p. 287.

[2] For illustrations of the appearance of tea leaves, and other leaves and berries, see Bell, Hassall, Blyth, König, Leach, Winton.

The Russians are said to have the most delicious tea of any nation in Europe. They have an inland trade with China, and choice teas are directly imported, without exposure to the heat and close air of the hold of a vessel, so injurious to teas of a delicate flavor. Their method of making tea also has much to do with its fine flavor, and samovars are a national feature, from which some lessons may be learned.

The samovar is a large brass urn, lined with block tin. The urn and the stand which raises it from the table are all in one piece, in those I have seen. The urns hold from four to eight quarts of water, which is poured in through a small hole, three quarters of an inch in diameter, in the top, and they are emptied by a stopcock or faucet, like any hot water urn.

It is usually one servant's duty in Russia to take care of the samovar, to fill it with the freshest of water, to kindle the fire, and to bring it in when all is ready for the table. A twist of paper is placed in the bottom of the cylinder, with some splinters of kindling wood. Upon this is placed charcoal broken into pieces the size of walnuts. The Russians themselves often have a special charcoal made from cocoanuts, the hard shells making a very dense, odorless charcoal, which gives off an intense heat. The fire is lighted from the grate below. The chimney is put on, and the fire is allowed to burn until all smoke and smell from the wood and paper have passed away, and the charcoal is in a glow. Then it is carried in and set upon the table.

As soon as the water sends out a jet of steam from

the hole at the top, beside the cylinder, the tea is made by the hostess. Now notice that the water has just reached the boiling point. It has lost none of its life or air. It is simply fresh, pure water brought to the boiling point. The teapot is made scalding hot, and the tea is taken from a caddy upon the table. At first only a little water is poured upon it. The chimney is taken off and the teapot is set upon the cylinder over the glowing coals, upon the same principle as setting the teapot in the top of the boiling teakettle on the fire, as we often see done here in our kitchens. In a few moments more boiling water is added, and the teapot replaced over the coals. The tea is poured into the cups when it has steeped sufficiently long, sugar is added, and instead of cream a slice of lemon is slipped into each cup. Fresh tea and water are put in the teapot, and it is again placed over the coals.

### COFFEE

One tradition relates that, in ancient days, a poor dervish, who lived in a valley of Arabia Felix, observed a strange hilarity in his goats on their return home every evening. To find out the cause of this, he watched them closely one day, and observed that they eagerly devoured the blossoms and fruit of a tree he had hitherto disregarded. He tried the effect of this food upon himself, and was thrown into such a state of exhilaration that his neighbors accused him of having drunk of the forbidden wine; but he revealed to them his discovery, and they at once agreed that Allah had sent the coffee plant to the faithful as a substitute for the wine.

The name of coffee is given to a beverage prepared from the seeds of plants, which are roasted, ground, and infused in boiling water. The seeds most used are those of the Arabian coffee tree (an evergreen, *Caffea Arabica*), which belongs to the natural order *Cinchonaceæ*, the same order to which belongs the tree from which are obtained quinine and the Peruvian bark of commerce. It is probable that the use of coffee has been known from time immemorial in Abyssinia, where the tree is native. In Persia it is known to have been in use as early as A.D. 875.

The first allusion to coffee in an English book is believed to be in Burton's "Anatomy of Melancholy": "The Turks have a drink called coffee (for they use no wine), so named of a berry as black as soot, and as bitter, which they sup up as warm as they can suffer, because they find by experience that that kind of drink, so used, helpeth digestion and produceth alacrity."

The introduction of coffee into Europe was bitterly opposed, and the use of it denounced from the pulpit. Nevertheless the tree has been cultivated in all tropical countries which have been colonized by Europeans.

While in Mohammedan countries its use as an antisoporific in the long devotional exercises rendered it obnoxious to the conservative priests, and while some held it to be an intoxicant, and so prohibited by the Koran, in England it seems to have been opposed by liquor dealers, who alleged that the popularity of the coffee houses was so great as to draw away their custom. The popularity of the coffee houses

also aroused suspicion of disloyalty in the gatherings, so that they were made the object of a royal proclamation by Charles II in 1675.

Coffee was introduced into England at about the same time as tea, and its use increased very rapidly, until it reached its maximum in 1854, when the import into Great Britain was 37,441,373 pounds. Since then the consumption has decreased, partly owing to a greater use of tea, and partly to the increase of coffee substitutes. The amount used in Great Britain in 1857 was one and a quarter pounds a head; in 1875–77 three-quarters of a pound; in 1904 only three-fifths. In Holland and Germany in 1885 about fourteen pounds a head were consumed; in 1904 less than seven pounds. In the United States the amount was in 1885 about eight pounds; in 1904 it was twelve pounds, and the United States consumed about half the total supply of the world.

Brazil now supplies more than one-half of the coffee of the world, and nearly 75 per cent of that used in the United States.

The most valuable constituent of coffee is *caffeine*, an alkaloid identical with the theine of tea. There is present about 1 per cent of it. The peculiar flavor and aroma of coffee are due to one or more oils or fats, which become changed to peculiar aromatic compounds in the roasting. There is about 13 per cent of these, and they probably possess the stimulating properties noticed in the infusion. Caffeic acid, an astringent somewhat like the tannin of tea, is present, but only from 3 to 5 per cent. Hence the action

of coffee is not as deleterious to the coatings of the stomach as is that of tea. Coffee also contains sugar to 5 or 7 per cent, which is all converted into caramel in roasting.

The exhausted berries also contain nutritious nitrogenous matter, and some Eastern nations drink grounds and all. In Sumatra the leaves are used, and seem to have a large proportion of the properties of the berry.

The effect of coffee on the human system is to counteract the tendency to sleep, and it is almost certain that it was this property which originally led to its use as a beverage. It also excites the nervous system, and when taken in excess produces contractions and tremors of the muscles, and a feeling of buoyancy and exhilaration somewhat similar to that produced by alcohol, but does not end with depression or collapse. Professor Johnstone thus describes the properties and effects of coffee: "It exhilarates, arouses, and keeps awake; it counteracts the stupor occasioned by fatigue, by disease, or opium; it allays hunger to a certain extent; it gives to the weary increased strength and vigor, and imparts a feeling of comfort and repose." Its physiological effects upon the system, so far as they have been investigated, appear to be that, while it makes the brain more active, it soothes the body generally, makes the change and waste of matter slower, and the demand for food in consequence less.

For soldiers and travelers exposed to great hardships, coffee is the best agent known for restoration of the exhausted energies. Its use can be abused, like

that of any other good thing, but, used understandingly, coffee is an important addition to one's diet.

There are few adulterants in whole coffee, though, as in the case of teas, inferior qualities are often substituted for the choicer varieties. It is very doubtful if the old story of coffee beans molded out of paper pulp deserves attention.

Glazing is the process of coating the coffee beans with white of egg or sugar, or with one of a variety of gums. This is ostensibly for the better preservation of the coffee, and for the purpose of saving the housewife the trouble of clarifying her own coffee. It may be questioned, however, whether the process is not for the purpose of deceiving the housewife with the substitution of an inferior bean for a better quality. If this is the case, then certainly glazing is a form of adulteration.

Ground coffee is variously adulterated. In Massachusetts the following adulterants have been found: roasted peas, beans, wheat, rye, oats, chicory, brown bread, pilot bread, charcoal, red slate, bark, and dried pellets made of ground peas, pea hulls, and cereals, held together with molasses.[1]

Of the ninety examples examined by the Massachusetts Board of Health in 1905 only four were found to be adulterated. Two were not labeled according to the law.

A small proportion of chicory in coffee is considered by many connoisseurs to impart a particularly agreeable flavor, and consequently its use is not condemned.

[1] Leach, p. 292

The difficulty about sanctioning such a mixture is that if you give a man an inch he will take an ell, and in the end chicory may be the chief constituent. Here again enters in the problem of injury to morals and loss to pocketbooks, and of the need for protection against "swindling."

Villiers and Collin[1] give the following analyses of two samples of chicory:

| | | In large granules. | In powder. |
|---|---|---|---|
| Soluble in water | Water (loss at 100° to 103°) | 16.28 | 16.96 |
| | Weight of total matter soluble in water | 57.96 | 56.90 |
| | Reducing sugar | 26.12 | 23.79 |
| | Dextrin, gum, inulin | 9.63 | 9.31 |
| | Albuminoids | 3.23 | 3.66 |
| | Mineral matter | 2.58 | 2.55 |
| | Coloring matter | 16.40 | 17.59 |
| Insoluble in water | Albuminoids | 3.15 | 2.98 |
| | Weight of the total insoluble matter | 25.76 | 26.14 |
| | Mineral matter | 4.58 | 5.87 |
| | Fat | 5.71 | 3.92 |
| | Cellulose | 12.32 | 13.37 |

As yet there has been no seed found which, when roasted and ground, corresponds with coffee, either in its physiological properties or in the chemical composition.

The detection of the presence of chicory, caramel, and some of the sweet roots, as turnips, carrots, and parsnips, is quite easy. If a few grains of the suspected sample are placed on the surface of water in a

[1] Falsifications et Alterations des Substances Alimentaires, p. 234; in Food Inspection and Analysis, p. 296.

glass vessel, beaker, or tumbler, each particle of chicory, etc, will become surrounded by a yellow-brown cloud, which rapidly diffuses through the water until the whole becomes colored. Pure coffee, under the same conditions, gives no sensible color to the water until after the lapse of about fifteen minutes. Caramel (burnt sugar) of course colors the water very deeply. Dandelion root gives a deeper color than coffee, but not as deep as chicory; this is true of bread raspings. The first two adulterations may be more readily detected by the taste, and the bread by its softening. Beans and peas give much less color to the water than pure coffee; they can be readily detected by the microscope, as can roasted figs and dates, or date stones. But the use of the microscope is not to be learned in one lesson, and the microscopical examination must be made by one who has skill. In months of practice one sees more and more each time the instrument is used, so that, while it is an invaluable aid to those accustomed to its use, it is as unreliable as the chemical tests in the hands of the unskilled.

The preparation of good coffee requires only an understanding of its properties, and is not as difficult or as dependent upon complicated apparatus as is often supposed. Raw coffee, when kept dry, improves with age. The best Java is said to be some seven or eight years old. To prepare the kernel for use, it must first be properly roasted by a quick heat, like that used for popping corn. The kernels should swell and pop in much the same way, though not to the same extent. When the flavor has thus been developed, and the berry

made brittle, it is to be ground in a mill or pounded in a mortar as fine as may be, and then, to obtain the full strength, placed in an earthenware vessel, covered with cold water, allowed to stand for some hours, and brought to the boiling heat just before use. While this is the most economical treatment, most people prepare an infusion made by pouring boiling water upon the fine coffee. The vessel should then be closed and allowed to stand at a boiling heat for five to ten minutes; it should never boil violently, as the delicate aroma of the coffee is then lost. According to one authority: "Coffee, to be good, must be made strong. From one to two ounces to a pint of water is recommended; three times the volume of milk may then be added. This is better than to add water. In countries where the best coffee is made, there is a concurrence of opinion that roasted coffee should not come in contact with any metal; but that it should be powdered in a wooden mortar, kept in glass or porcelain, and infused in porcelain or earthenware jugs, or other closed vessels." An expensive method of preparation is by the percolation of boiling water through the coffee, drop by drop. The simplest apparatus for this is a flannel bag, which carries the coffee, suspended in the coffee pot.

The following directions for making coffee in three different ways are given by the courtesy of Mr. Frank A. Allen, of the Oriental Tea Company, of Boston.

### DIRECTIONS FOR MAKING COFFEE

1. Fill the coffee pot with cold water. Take the required amount of coffee and turn it in. Let it float

on the water without stirring. Place on the stove to heat, and remove from stove the moment it begins to boil. Decant slowly and carefully into the coffee pot or urn for the table, without disturbing the grounds which will be settled at the bottom of the pot.

2. Measure out the required amount of coffee and put into a bowl, and add barely enough boiling water to dampen it. Let it stand seven minutes soaking. Put the soaked coffee in the coffee pot, pour on the needed amount of boiling water, and stand the coffee pot on the stove where it will keep *very hot, but not boil,* for ten minutes. Pour into the table urn, as in Rule 1, and serve. A fine-mesh cheese cloth bag to hang in the pot and hold the coffee insures clear coffee by this method. But be sure and soak seven minutes before putting in the bag.

3. If a French coffee pot or urn with a leacher to strain the coffee through is used, be sure to put the dry coffee needed into a bowl, with barely enough hot water to moisten, and soak seven or more minutes. Then put into the leacher, pour the needed amount of boiling water on it, and let it strain through.

### COFFEE SUBSTITUTES

We find in Farmers' Bulletin No. 122, 1900, that coffee substitutes of domestic manufacture have long been known. An infusion of parched corn, or corn coffee, has met with some favor in the household as a drink for invalids, etc. Parched wheat, peas, beans, bread crusts, and corncobs, as well as sweet potatoes cut into small pieces and dried and parched, have also been used.

The coffee substitutes found on the market today frequently claim a high food value as well as a special hygienic quality. "The food value of any such beverage is evidently due (1) to the material extracted from the coffee (or other substance) by the water used, and (2) to the sugar and milk or cream added to the infusion."

The food value of coffee substitutes has been studied by the Maine Experiment Station. Flour, meal, and other ground grains contain little soluble material, but when roasted a portion of the carbohydrates is caramelized and rendered soluble. The infusions studied were made according to directions, varying from 20 to 180 cups a pound of material. It was found that the average infusion had the following composition: water, 98.2 per cent; protein, 0.2; carbohydrates, 1.4; fuel value, 30 calories a pound.

Skim milk, which is considered a rather "thin" beverage, contains: protein, 3.5 per cent; fat, 0.3; carbohydrates, 5.15; or almost twenty times as much food material as the averages made from cereal coffee. If made according to directions one would have to drink 4.5 gallons of an infusion of one of them which made a special claim to high nutritive value, in order to get as much food material as is contained in a quart of skim milk.

The infusion of true coffee also contains very little nutritive material. It is not ordinarily consumed on account of its food value, however, but on account of its agreeable flavor and stimulating properties.

In Europe hundreds of proprietary articles are sold as coffee substitutes, such as "Datel Kaffee," wheat,

chicory, figs, and coffee; "Hygienic Nahrkaffee," cereals and acorns; peanuts, lupines, and date stones enter into other brands.

In America there are a number of favorite substitutes prepared from roasted cereals, ground peas, chicory, and other harmless material.

In the decade just passed the mixture of cereal coffee with the genuine coffees has become very general. A few of the preparations labeled as cereal coffees in reality contain a large percentage of coffee, at least in one case as much as 30 per cent.

It has been said that "in coffee substitutes, coffee itself should be considered the adulterant."

The present custom in advertising coffee well illustrates modern methods, which should be understood by the buyer.

A gentleman came to engage the author as expert in a legal case against a firm which sold a coffee warranted to contain no Java or Mocha coffee, and to be free from the deleterious effects of these coffees. The attending physician had forbidden coffee to the plaintiff's wife, and had prescribed this brand. The patient grew steadily worse until it was discovered that the article used was nearly half coffee, not Mocha or Java, but presumably one or more of the dozens of brands now on the market from tropical countries with which trade has been established in recent years.

## COCOA

The cocoa of commerce is chiefly prepared from the seeds of the plant *Theobroma cacao*, which grows in

the West Indies, in many South American countries, and in some parts of Asia and Africa.[1]

The earliest references to the chocolate plant are in the accounts of the explorers who followed Columbus. It appears to have been known to the inhabitants of Central America from time immemorial. It was introduced into Europe by the Spaniards in 1520, probably before either tea or coffee was generally known.

After its introduction it was at first only a luxury, but now it is a necessity. England and the United States each uses annually about three-quarters of a pound a head.

The term *theobroma* implies food for the gods, and is the name given to the plant by Linnæus, who is said to have been very fond of the beverage prepared from cocoa. The Mexicans called it *cacaoa quahuitl*, and the beverage *chocolatl;* and we probably derive from these native names our words *cocoa* and *chocolate.*

The cocoa bean contains 50 per cent of fat, 13 per cent of nitrogenous substance, half of which is soluble, about 7 per cent of a tannin-like principle, 4 per cent of starch, and about 1 per cent of theobromine, an alkaloid resembling theine. Thus it combines in a remarkable way the important substances which constitute a perfect food, and it is not strange that it holds so high a place in popular favor.

For the highest grades of chocolate the beans are selected with great care and then thoroughly cleaned

[1] A clear idea of the natural history of the plant and of the modern method of cultivation in South America may be obtained from The Chocolate Plant and Its Products, published by the Walter Baker Company.

from all dust and foreign matter. The next step in the process of preparing the chocolate for market is the roasting, and here the utmost caution is used to secure a uniform effect; for if the seeds are under-roasted the full flavor is not obtained, while in over-roasted seeds the flavor is likely to become bitter. By the roasting, the shells become detachable, and are removed and sold as *cocoa shells*, while the beans, merely cracked, are sold as *cocoa nibs*. As some time is required to soften the cracked cocoa, the prepared forms are preferred, with or without fat. For these preparations the beans are ground to an extreme fineness, so as to form a perfectly homogeneous mass. If the chocolate is to be a plain chocolate, it is flavored delicately and poured immediately into molds. If a sweet chocolate is to be made, the ground chocolate is mixed with a definite proportion of perfectly pure, finely pulverized sugar, flavored with the purest vanilla, and poured into molds. When the chocolate is cooled and formed into cakes, it is wrapped and packed for the market.

Many persons find in chocolate too much fat for easy digestion. In certain preparations a definite proportion of the oil is extracted, and we have *breakfast cocoa*, a valuable food even for delicate stomachs.

In inferior (not necessarily cheaper) grades of chocolate chemical means are used for its preparation from the seed instead of the natural physical means which preserve all the characteristic virtues. For instance, they may be treated with caustic or carbonated alkalies to increase the solubility of the fat, and deepen the color which gives an impression of greater solubility.

In most cases these chemical additions are found in the ash after wholly burning the preparation.

Sometimes an attempt is made to supply the loss of flavor by the use of fragrant gums.

Adulterations are frequently found in the sugar which is combined with chocolate, and in the vanilla. Or, on account of the high price of vanilla, an artificial extract is substituted. Sometimes ferruginous earths have been found, and occasionally foreign fats are used.

"In preparing chocolate as a beverage for the table a mistake has frequently been made in considering it merely as an adjunct to the rest of the meal, instead of giving it its due prominence as a real food, containing all the necessary nutritive principles. A cup of chocolate made with sugar and milk is in itself a fair breakfast."[1]

"Chocolate or cocoa is not properly cooked by having hot water poured over it. It is true that as the whole powder is in suspension and is swallowed, its food material can be assimilated as it is when the prepared chocolate is eaten raw; but in order to bring out the full fine flavor and to secure the most complete digestibility, the preparation, whatever it be, should be subjected to the boiling point for a few minutes."[1]

Among the nations of tropical America it was the custom to beat a mixture, of which chocolate was the chief ingredient, into a froth by means of stirrers or mallet-like implements, thus making a delicious beverage.

[1] Suggestions relative to the cooking of chocolate and cocoa in The Chocolate Plant and Its Products.

Thomas Gage, in his "New Survey of the West Indies," says: "The name chocolatte is an Indian name, and is compounded, as some say, from *atte*, or as others, *atle*, which in the Mexican language signifieth water, and from the sound which the water (wherein is put the chocolate) makes, as *choco*, *choco*, *choco*, when it is stirred in a cup by an instrument called a 'molinet,' or 'molinillo,' until it rise and bubble into a froath."

A similar thick, foamy drink may be made by the addition of one tablespoonful of cornstarch, three tablespoonfuls of sugar, and two ounces of chocolate to a quart of milk. The cornstarch should be mixed with about a gill of cold milk, the chocolate melted with the sugar over hot water, and all added to the remainder of the milk just as it comes to the boiling point. If a thinner beverage is desired, the cornstarch may be omitted.

In making tea we make an infusion. In making coffee we make either an infusion or a decoction. Now in making cocoa from the nibs or the cracked cocoa, we make a decoction; that is, the cocoa must actually boil. If it stands upon the stove or range, and steeps without boiling, we have an infusion, and we obtain as a result an intensely bitter drink. But if it boils — and it is an important, curious fact the difference a few degrees of heat will make — we have a smooth, oily, nutty beverage, which is most agreeable to drink, and very nutritious also, which the bitter beverage is not. There is the same difference between an infusion and a decoction of coffee, but the bitter of coffee is not so unpleasant nor so marked. Tea, on the contrary, and

also all herb teas, like mint, catnip, etc, are harsh and bitter when boiled, losing all their fragrance and delicate flavor. Tea is more of a mere beverage than coffee, which approaches a liquid food, though not so nearly as cocoa does.

# CHAPTER IV

## MILK, BUTTER, CHEESE, EGGS

### MILK

NEXT to water the milk supply of the family must be looked to.

The milk of animals has always been used as human food. In early ages it was the milk of goats, asses, etc., which was common; now, however, cow's milk is used all over the world.

The composition of milk may be roughly stated as follows: water, 86 per cent; lactose, or milk sugar, 5.5 per cent; milk fat, 4 per cent; casein, or curd, 4 per cent; saline matter, 0.5 per cent. The fat is held in suspension in the liquid in the form of globules, of which it is estimated that there are about three and a half millions in every cubic millimeter.

The variations in the food value of milk are great, so that it is quite probable that one man pays much more than his neighbor for the same amount of nutrients.

Milk is often called the perfect food, since it contains all the elements necessary for nutrition, and in the right proportions. One of the greatest advances in modern medicine, as well as in wholesome living, is the recognition of milk as an article of diet, especially for invalids, young people, and fever patients. Most persons can

digest it when a little lime water is added, if it does not suit them without it.

For infants milk is *the* important food. Until they are twelve or thirteen months old it should be the only food. It is essential, therefore, that the milk supplied be of good quality, and from healthy, well-fed animals. Unfortunately, however, it is true that the deaths of many children from cholera infantum and kindred diseases are due to injurious milk.

According to the secretary of the Massachusetts State Board of Health, deaths from diarrhœal diseases are much more frequent among bottle-fed children than among those fed on the mother's milk. He estimates that ninety per cent of the deaths among children were of those fed on bottle milk. A similar estimate is made by New York authorities.

Since infant mortality is a direct loss to the State, as well as a personal grief, communities are waking up to the necessity for a careful investigation of causes, and for stringent regulations as to the purity of the milk.[1] The deterioration in the milk of late years is due largely to the change from the clean, intelligent dairy woman who cared for the milk, to the hired, irresponsible laborer who has no sense of cleanliness.

The ordinary cow barn is filled with dust and filth, and in the summer with flies, all contributing possible disease-bearing organisms. Among these are certain bacteria which find an especially congenial home in milk and multiply rapidly, causing the so-called lactic

[1] For the question of the control of the milk supply, see Farmers' Bulletin No. 42, Office of Experiment Stations; also Bulletin No. 20, Bureau of Animal Industry.

fermentation; that is, the milk sugar undergoes decomposition, whereby lactic acid is formed and the milk becomes sour.

Inasmuch as it has been proved that milk can act as a carrier of infection, the utmost care should be taken in the dairy to render it impossible for the milk to be exposed to any kind of impurities.

Another potent cause of poor milk is the concentration of consumers in the cities, necessitating the transportation of milk from greater distances, so that it is of greater age. Hence has arisen the practice of adding preservatives to offset the lack of cleanliness.

But greater danger to health comes from the use of milk produced under improper conditions, and from diseased or wrongly fed cows, than from any substances added to the milk — unless the water taken from a foul well is used.

The most frequent method of adulteration is by the addition of water, which reduces the nutritive value for the same volume of milk.

Other adulterants are coloring matters, added to give the requisite yellowness, and various chemical preservatives to prevent souring.

The common belief that much of the milk sold is a mixture of chalk and water is quite unfounded.

It is a wrong to sell watered milk, but it is a greater wrong to use foul water to dilute the milk. The pollution of the milk by means of the swill-fed cow is not nearly so prevalent as formerly, for a much closer watch is kept by the inspector.

Since cream, which brings a higher price than milk,

has come into general use, "topped" milk is not uncommon. Thus, by loss of the fat, the nutritive value is again reduced, and inanition of the child is the result.

While *skim milk*, if sold as whole milk, must be considered an adulterant, it has in itself a definite food value. Whole milk and skim milk contain practically the same amount of protein, but the former costs at least twice as much. "As a source of protein, therefore, the skim milk is twice as economical as whole milk. On the other hand, the *fuel* value of skim milk is practically but one-half that of whole milk, so that a given amount of energy is given for the same price, either in whole milk or skim milk."[1]

Of practically the same composition as skim milk is *buttermilk*, which is the liquid left after separating the fat of the cream in butter making. To many persons this is a more agreeable beverage than either whole milk or skim milk.

The housewife should note certain evidences of good and bad milk: (1) There should be no sediment of dirt on standing. (2) There should be about one-sixth the total depth of cream — the narrowing neck of a bottle may make it seem even more. The milk should keep sweet twenty-four hours, and when it tastes sour it should separate into curds and whey, not be simply a uniform white mass, as is likely to happen when soda is used to keep it.

The Quarterly Bulletin of the Dairy and Food Commission of the State of Wisconsin gives the following test as "a practical means of tracing the source of

[1] Farmers' Bulletin No. 72, Office of Experiment Stations.

tainted conditions in milk. The test is made by adding rennet to milk; after curdling, the curd is cut into small pieces, thus allowing the whey to separate as in cheese making. The drained curd is then incubated at about blood heat to facilitate the rapid growth of gas-forming bacteria. Organisms capable of forming a gassy curd are thus able to overcome the lactic bacteria, so that within six or eight hours the presence of possible taints may be demonstrated. Taints caused by other than gas-forming organisms may also be detected by this forced development. Curds made from good milk occasionally show large, irregular, so-called mechanical holes, due to the lack of pressure on the curd particles, while poor milks contain innumerable small pin holes and possess a decidedly bad odor."

Many States have commissions to investigate the conditions of dairies and creameries and to publish an analysis of the results. The following from a report of the Wisconsin State Commission shows the care with which such investigations are pursued:

"Date, ——; name of creamery, ——; proprietary or cooperative, ——; location, ——; owner or manager, ——; post-office address, ——; name of operator, ——; he has not attended dairy school at ——; number of patrons, ——; number of pounds of milk daily, ——; number of pounds of butter daily, ——; loss of fat in skim milk, .20 per cent; skim milk was divided by automatic weigher; there were no screen doors or windows; cream hauled to —— daily; drainage underground a distance, then to open ditch along the road; some bad odor in creamery; location and condition of

skim milk tank upstairs, not clean; condition of building, fair; the building is painted outside; condition of apparatus, poor; condition of surroundings, fair; condition of patrons' milk cans, fair; condition of milk in cans, good. Remarks: A general lack of cleanliness in this place."

An example of bad conditions may be taken from a town in Massachusetts whose milk supply is said to increase fifty per cent in summer, owing to the influx of summer visitors. Of 160 dairies examined, two-thirds were found with conditions to which it was necessary to call the attention, not only of the owners, but also of the Board of Health.

There were 100 cow barns needing a general cleaning and whitewashing. In seventy-seven cases the cows were in such dirty condition that their milk could not be drawn without becoming contaminated with detachable filth. In forty-four barns there was an accumulation of manure which required removal, and forty-five cow-yards contained large pools of liquid manure. In one case the owner bedded his cows in horse manure. In four barns the privy was situated directly behind the cows, and in one the floor was made to serve as a privy.

The Illinois Experiment Station has issued an excellent bulletin (No. 91, December, 1903) on preventing the contamination of milk.

The Storrs Experiment Station of Connecticut in June, 1906, issued Bulletin No. 42, considering the quality of milk as affected by common dairy practices.

Encouragement to produce good milk is needed instead of a cry against bad milk.

*It always costs to be clean*, and clean milk costs more to produce and deliver. Several right-minded persons have tested the public's willingness and have found it wanting. This must be remedied.

If housewives would unite in demanding certified milk, and be willing to pay for it, the quality would rapidly improve. It is poor policy to balk at an increase in price which means health and even life, instead of illness and death, to thousands of children.

Too loud a note cannot be sounded in warning, but it must be based on truth, not on exaggeration. The twentieth century woman should not allow herself to be imposed upon by sensational literature, but should inform herself of local conditions.

Cooperation is here a necessity, and should be supported as a business venture.

### CONDENSED MILK

The extremely unstable character of milk, and the consequent difficulty of transportation and preservation for any length of time, have led to the adoption of various processes for concentrating the valuable constituents, which are only about 14 per cent of the weight, into a smaller bulk and more stable condition. The usual process consists in simple concentration. The milk is evaporated in vacuum pans, and toward the end heated to 212° F., in order to destroy any germs of mold. It is put up in tin cans, sealed hermetically, and may then be kept any length of time. Sometimes a little sugar is added. In either case, the product is sold as condensed milk, which often contains about one-third as much water as the original liquid.

Evaporated milk is offered as a solution of the problem of supplying a safe milk for children and invalids during the summer months. It is pure milk evaporated, without the addition of sugar, in a vacuum pan at a temperature of about 130° F., or below 150° F., which is much lower than that at which condensed milk is usually prepared. At this low temperature the milk is far less changed from its normal condition, and is more digestible than is the case when it is heated to boiling.

### CREAM

When milk is allowed to stand at rest for some hours, the fat globules rise to the top, forming a layer from one-tenth to one-fifth of the total thickness. This layer, rich in fat, is called cream, and contains from 20 to 40 per cent of fat.

A sign of increasing prosperity and of more luxurious living is the extensive use of cream purchased as cream. Apartment dwellers have no facilities for "setting" the several quarts of milk needed to supply the breakfast table with this esteemed adjunct to the coffee, fruit, and cereal, even if the milk could be delivered to them in a sweet condition.

The separator at the dairy, a truly modern machine, does in a few minutes the work of hours in dividing most of the fat from the fluid emulsion without churning it to butter. Reduced to one-fifth the bulk, it is much more easily transported and delivered to customers. It is sold as heavy or thin cream.

Probably this use of cream has been the means of

abolishing the now berated American breakfast of steak or eggs and bacon with hot breads.

The good prices obtained for cream have doubtless led to some abuses, such as the addition of thickening substances and preservatives. Sucrate of lime, or viscogen, is not in itself harmful, nor does it injure the cream. If, however, a person is avoiding the use of lime salts in water and other foods, this unknown amount of the forbidden substance may prove hurtful. Gelatin is not an objectionable article of diet when properly prepared, but as a thickener of cream it is out of place.

Cream naturally thickens on standing, owing to the chemical changes in even clean cream.

Sterilized cream has not quite the flavor of fresh cream, but it is safer than dirty cream unsterilized. Fortunately, cream is very easily changed in taste and odor by foreign substances, and therefore is not so deceptive as other adulterated products.

The use of cream instead of milk for infants renders it imperative that the public generally should be awake to the conditions of the cream market and should sustain the city and state authorities in their endeavors to protect the helpless children.

The matter is in the hands of the buyer. If he will use only certified milk and cream, then the laws can be enforced.

### BUTTER

Butter is a very important article of diet, especially in English-speaking countries. It is of all animal fats the favorite, not only on account of its pleasant taste,

but because it is the most easily digested. Butter with bread forms an almost perfect food.

Herodotus, in his account of the Scythians, makes an obscure mention of butter, and this is the earliest reference known. Dioscorides is the first to observe that when melted and poured over vegetables it serves the same purpose as oil, and that it can be used in pastry. It is not mentioned by Galen, or other writers of his time, as food, and indeed to this day it is little used in southern countries, so that it might almost be said to be a product of northern civilization in its present uses. There is undoubted evidence that butter was well known to the Anglo-Saxons and used for salves and medicines.

Butter is prepared by separating the fats from the water and curd of milk by agitation, which causes the lighter particles of fat to rise. These then are collected and worked into a homogeneous mass. This process seems to be very successfully accomplished at present by the centrifugal machine.

Good butter consists of fats, water, and curd. The water varies from 8 to 16 per cent. Over 16 per cent is injurious to the keeping of butter. There should not be over 1 per cent of curd left, because it tends to grow rancid and mold, thus tainting the butter.

The manufacture of butter has passed from the care of the farmer's wife to that of the company employee — to its advantage in some respects, but with certain deteriorations.

The skilled dairy woman, with a pride in the flavor and keeping qualities of her product, furnished an arti-

cle rarely found today, in spite of the artificial ripening of the cream by $B^{41}$, or whatever bacterium is the favorite. On the other hand, creamery butter is of a more uniform quality and better flavor than the butter of ignorant and careless butter makers.

There is a great temptation to cheat the pigs to increase the yield of the valuable product, butter, by stuffing with the curd. The old-fashioned country butter, packed in tubs to keep eight months, contained only 10 to 12 per cent water and curd. The creamery butter of today, especially the light-colored, unsalted variety, frequently contains 20 per cent water and 5 to 10 per cent curd, lessening its fuel value, although increasing its nitrogenous value, which is not what we expect to pay for in butter. The author has found as high as 33 per cent of curd.

This excess of curd does not injure the flavor, but rather adds to it when fresh. Since, however, it is more readily attacked by decomposing organisms which give very disagreeable tastes and odors, such butter soon spoils and may become dangerous. It should therefore be eaten while fresh.

The United States standard for fat is not less than 82.5 per cent.

Butter is very sensitive to unpleasant odors, and must be kept with great care, in closed vessels, since even a few hours' exposure to ordinary air injures the delicate flavor. It would be well if all girls could serve an apprenticeship in a good dairy for a few weeks, in order to learn cleanliness.

The 70 to 86 per cent of butter fats are for the

most part identical with those in olive and palm oils, and in other animal fats; but the peculiar flavor of butter is due to the presence of 5 to 8 per cent of butyric, capric, caprylic, and caproic acids. These fatty acids are much less stable than oleic, palmitic, and stearic acids, which are often called the fixed fatty acids. In butter, human fat, and goose fat, palmitic acid is the most abundant. It is so named from its occurrence in palm oil. Oleic acid is common to these fats, and to beef, mutton, and hog fats. Stearic acid is found in small quantities in butter, while it is a chief and constant constituent of beef tallow.

During the Franco-German War, in 1870–71, a French chemist, Mége-Mouries, invented a process for obtaining from other animal fats the fatty acids common to them and to butter, and making from them a very fair artificial butter, for the use of the French army. The name oleomargarine is derived from the fatty acids present — oleic and margaric, as the mixture of stearic and palmitic acids was formerly called.

Oleomargarine and butterine are prepared in a similar manner from oleo oil (beef fat) or neutral lard and milk by churning and salting and coloring to imitate butter. These are wholesome food products, and their use furnishes a much needed fat to an economical diet. As a rule oleo keeps better than creamery butter, and if the latter is loaded with curd the oleo has a higher food value. But they should be sold under their own names.

Rarely has there been a fraud so difficult to detect, since not only the apparent but the real

differences between genuine and artificial butter are but slight. Yet careful chemical analysis will show about 87 per cent of fixed fatty acids in butter, and about 95 per cent in the fats used in making artificial butter.

Reichert's process of determining the volatile acids peculiar to butter answers well in skilled hands. An analytical chemist has little difficulty in deciding upon the quality of a suspected sample. The expense attending such an examination, however, prevents its application as often as is desirable. The detection of the crystals of the different fats, as proposed by Taylor, may be an important aid. Some simple and easily applied test is much to be desired, but the public yet awaits its discovery.

Butter which has become rancid may be sweetened or "renovated" on a large scale by a process long used by the housewife in essential. It is melted, the curd and brine allowed to settle, and the scum removed; the butter fat is then aerated by a current of air blown through it in some cases to take out disagreeable odors, and then churned with milk, whole or skimmed, cooled, and packed. This butter will not keep as long as fresh, well-worked butter, and if sold without a correct label is a fraud.

The carrot and certain weeds served the farmer for his butter color. The dairies used annato, but the creameries find the coal tar yellows preferable. These may be detected by boiling bits of silk or wool in an alcoholic solution of the butter fat with the addition of water and cream of tartar.

One of the State chemists says, "The practice of coloring butter is now so firmly fixed, and the taste of consumers so bent to the false standard, that it is not probable that it will ever be abandoned."

### CHEESE

Good cheese is composed of the total solids of milk curdled by rennet before the milk sours. Poor cheese is made from skimmed milk, and hence has less fat. Cheese is really a condensed milk, less the sugar and part of the mineral salts, and is a valuable article of diet, replacing meat, to a great extent, with those whose stomachs it suits; but on account of unjustifiable prejudice it is much neglected. One pound of dry cheese is estimated to contain as much nitrogenous substance as a pound or a pound and a half of beef as purchased. The rind of the cheese may have been brushed over with some metallic salt to preserve it from the attacks of fungi, etc, so that it is well to pare it off before eating.

The ripening of cheese has been the subject of much study.

The dairy schools give close attention to the production of all varieties, and very soon American cheese may be had of any desired quality, instead of the former crude, tough substance that is digested only with difficulty.

The great advantage of cheese is that it may be put up on the dairy farm under cleanly conditions and then transported and kept without change, being too concentrated for ready decomposition.

Dangerous preservatives rarely find their way into

cheeses. "Filled" cheese has the butter fat replaced by foreign fats, such as lard and cotton seed oil.

COMPOSITION OF DIFFERENT KINDS OF CHEESE[1]

| | Water. | Casein. | Fat. | Sugar. | Ash. |
|---|---|---|---|---|---|
| | Per cent. | Per cent. | Per cent. | Per cent. | Per cent. |
| Cheddar | 34.38 | 26.38 | 32.71 | 2.95 | 3.58 |
| Cheshire | 32.59 | 32.51 | 26.06 | 4.53 | 4.31 |
| Stilton | 30.35 | 28.85 | 35.39 | 1.59 | 3.83 |
| Brie | 50.35 | 17.18 | 25.12 | 1.94 | 5.41 |
| Neufchatel | 44.47 | 14.60 | 33.70 | 4.24 | 2.99 |
| Roquefort | 31.20 | 27.63 | 33.16 | 2.00 | 6.01 |
| Edam | 36.28 | 24.06 | 30.26 | 4.60 | 4.90 |
| Swiss | 35.80 | 24.44 | 37.40 | . . | 2.36 |
| Full cream, mean of 143 analyses | 38.60 | 25.35 | 30.25 | 2.03 | 4.07 |

## EGGS

Eggs contain all the necessary constituents of food in the most concentrated form — so concentrated as to be unsuited for the whole of the daily ration. For convalescents they are invaluable when they can be obtained fresh.

Eggs as bought consist of about 11 per cent shell, 32 per cent yolk, and 57 per cent egg-white or albumen. The yolk has the highest food value because it contains less water and more fat. Egg-white contains 86.2 per cent water, 12.3 per cent proteid, 0.2 per cent fat. Egg-yolk contains 49.5 per cent water, 15.7 per cent proteid, 33.3 per cent fat. The yolk contains more mineral matter and is an especially valuable food in anæmic and nervous conditions.

The egg production of the United States is one of

[1] Table compiled by Woll, in Leach, p. 158.

the most important and valuable. It is estimated at not less than a billion dozens. Dietary studies have shown that eggs constitute three per cent of the total food.

The normal eggshell has a natural coating of mucilaginous matter which prevents the various microorganisms from passing through, at least for a time; but if this is washed or rubbed off putrefaction sets in and proceeds with rapidity because of the rich food material.

Water evaporates through the pores of the shell, so that old, unvarnished eggs are of greater specific gravity than new-laid.

Cold storage in a fairly moist atmosphere is the usual method of keeping and transporting eggs. They must be kept by themselves as they absorb odors very readily.

Various methods of preserving — packing in oatmeal or bran, covering with brine or lime water, treating with salicylic acid, varnishing with collodion or shellac — have been tried, with a usual loss of half the pack.

At the North Dakota Experiment Station marked success has been obtained by coating the fresh, unwashed eggs with a dilute solution of water glass (one part of the thick, not too alkaline syrup as purchased to ten parts of water). These eggs are said to keep all their qualities, even that of beating up well for frosting.

Desiccated eggs have been successfully prepared for provisioning camps and expeditions. The water being removed enables four times the food value to be carried in the same weight.

Several egg substitutes have appeared on the market. One of considerable food value is said to be made from skim milk and flour, probably slightly colored. Others seem to be chiefly starch highly colored. These cannot replace eggs in the diet, since they contain little nitrogen and almost no fat.

One "remarkable substitute for fresh eggs" has recently been put upon the market with the claim that "the contents of this can is equal to and will do the work of thirty-six fresh eggs." Examination shows it to consist almost wholly of artificially colored corn meal. The most astonishing thing about such frauds is that intelligent women can be found to buy them. The German immigrant woman would know better.

# CHAPTER V

## CEREAL FOODS — BARLEY, RICE, OATS, MAIZE, RYE, AND WHEAT

THE term cereals has come to have a limited significance since the universal introduction of breakfast foods.

The public needs to be reminded that there are only six or seven grains in common use and that the 365 brands of cereals must be made from these, and therefore that the same thing must be sold under many names.

Cereals all belong to the family of grasses, and some member of the group flourishes in every latitude. Barley grows even within the arctic circle, and thence southward are found, in the following order, oats, rye, wheat, maize, while within the tropics rice is found. The seeds of these plants have been used for the food of man from time immemorial. They are the most abundant of all food substances. The Egyptians have a tradition that barley was the first to be so used.

A general description will serve for all the seeds or kernels. The shape is from round to oval or oblong, with a groove on one side running the length of the kernel. This indentation serves to protect the germ which it incloses. Outside the germ are usually recognized three layers. The outer layer, which serves to hold the inner ones compactly together and to keep

them dry, is made up chiefly of woody fiber, or cellulose, and is comparatively worthless for the purpose of nutrition. Next there are in most grains one or more layers of cells which contain nitrogenous and phosphatic compounds; while within, forming the body of the seed, is found the mass of starch granules, larger and smaller, with intermingled cells of the glutinous or albuminoid constituents. All these are supported in a loose framework of cellular tissue. The proportion of these constituents varies greatly in the different grains and in varieties of the same grain. Rice has the largest proportion of starch, and oats contain the most oily and phosphatic material.

The term *flour* is often used to designate the meal or powder obtained by the grinding of any species of grain or seed. But the use of the word in the United States is for the most part limited to the finely ground portion, the more starchy portion; while by the term *meal* — a Saxon word meaning finely ground, soft to the touch — is understood the product of the grinding of the whole grain. Both terms are generic, and are qualified by a descriptive adjective, as wheat flour, corn meal, etc.

Barley and rice are for the most part cooked whole; oats and maize are coarsely crushed; while wheat and rye are finely ground and separated into the flour, or white sifted starch and gluten, and the husk or bran which is left after the bolting, as the sifting is technically called.

The greatest change in the habits of food consumption which the last twenty years has developed is in

the greatly increased use of prepared cereals — both cereals which may be cooked quickly and those which may be eaten uncooked.

There are several causes contributing to this result. Chief of these is the money to be made by the quick marketing of a popular food. When a particular name begins to pall, the same material, or that combination with a slight variation in appearance, is put on the market under a new name. Prizes are offered for a name which will sell the packages most quickly. Much ingenuity has been spent on this manufacture of cereals into new shapes, and more on the advertising description of them. The constant demand for something new, as if Burbank could indeed use the wizard's wand on the grain fields, has flooded the market with prepared foods — a brand for every day in the year made from the varieties of grains known for thousands of years.

The introduction of gas stoves and the habit of a continental or meatless breakfast, often eaten in the living room, have created a demand for a tasty cereal to be served without the trouble of cooking. A morbid craving for variety and the too often poor quality of the cooked cereal served in boarding houses and hotels has also favored the use of the various "flakes," which make such admirable conveyors of cream and which crackle so delightfully.

There is little cause for alarm as to the introduction of poisonous substances into these products. It may be possible that in some cases impure chemicals have been used, but it is very doubtful if direct addition of

poison has occurred. The chief danger is to be found in the ignorance of the public as to food values and the needs of the body.

In order to furnish the heat and energy for a day's work or pleasure at least eight or ten ounces of carbohydrates and three ounces of fats are needed. These fluffy, flaky materials occupy space, but have little weight compared with more solid food. Therefore the consumer is apt to be deceived as to the quantity. Again, these foods are partly transformed or predigested, so that they pass quickly into circulation, giving a satisfied feeling, which soon passes, leaving a hunger liable to be quieted by nibbling at candy, chocolate, or crackers between meals.

If deluged with rich cream and sugar the food value of the dish is greatly enhanced. The addition of the sugar, however, for a breakfast dish is not to be recommended. Fermentations inimical to the best assimilation of food are likely to arise.

It is interesting to note that in the recent discussion of pure food legislation the clause requiring the weight to be put on the package failed of enactment. That would have affected the cereal foods, for when many housewives realize that they pay twenty-five cents a pound for some fancy name, but for no more food value than they can obtain for two and a half or three cents, then they will count the cost of gas and time to see if they can afford the difference.

Full analyses and descriptions of the important brands have been made by the states of Wyoming, Maine, and Connecticut, for instance. From the published facts the following comparison is compiled:

BULLETIN No. 84, MAINE EXPERIMENT STATION, 1902, ORONO, ME.

CEREAL BREAKFAST FOODS

*Market Price*

| | Cost per pound Cents |
|---|---|
| Nichols Snow White Samp | 2.1 |
| Quaker Oats | 3.1 |
| Nichols Pearl Hominy | 4.5 |
| Quaker Rolled White Oats | 6.3 |
| Pettijohn's Breakfast Food | 7.0 |
| Cream of Wheat | 8.8 |
| Malt Breakfast Food | 9.4 |
| Wheatena | 10.7 |
| Grape-Nuts | 14.6 |
| Shredded Whole Wheat | 15.0 |
| Force | 16.5 |
| Flaked Rice | 18.2 |
| Granose Flakes | 22.4 |
| Granula | 27.2 |

For ten cents one buys of the last named 677 heat units of food value, and of the first 8,200 heat units — enough for nearly three days' ration. The cost of gas for cooking is, however, to be taken into account.

*The truth about breakfast foods is* that the housewife saves time and trouble at considerable cost to her pocket.

The Bulletin says: "Of the fifty brands recently collected only twenty-one are found in the list of three years ago. There seems to be a tendency on the part of manufacturers to substitute new and attractive names for a product that has been before the public for some time."

This is caused in part by the deterioration which

the manufacturers permit, either by the packages becoming stale and even wormy or by less care in production. During the time of introduction the new name means fresh material.

Rolled oats, and some other grains, are softened by steaming raw, crushed by rolls, and then dried so as to keep. The starch is then more soluble. Sometimes the heat is dry heat, either at first or after steaming, and then there is a dextrinizing and browning, like the crust of bread.

The malted foods are mixed with barley and partly predigested.

These prepared cereals have their place, but the family provider, not the manufacturer, should decide what that place shall be in each case.

The lazy habit of obtaining information (?) from the label, instead of developing common sense and real knowledge, is responsible for most of these drains on the pocket.

As stated before, it is within the power of every housewife to *know*, and the bureau of information should find a place in every club.

As to the loss in food value by this predigestion of the prepared foods the last word has not been said. Cooking doubtless changes the relations of the various ingredients, but the waste within the body of the mushy cereals may cause some to be more than double the value of others.

The steam cooking either does not develop or dissipates the flavor, so that one tires of the mush or adds sugar — a dietetic sin — and cream and fruits. In this

respect the flaked and toasted varieties are more "tasty," if not more digestible, as they may well prove, however, if thoroughly masticated.

### BARLEY

Barley belongs to the genus *Hordeum*. It is probably a native of Northern or Central Asia, but it has a remarkable power of adapting itself to a great range of temperature, and has a wider distribution than wheat or oats. On the eastern continent its culture extends from 70° north latitude to 42° south, and in America from 62° north to 20° south. Its use as an article of food is coeval with the history of man. It yields a greater produce per acre than any other grain except rice. It was largely cultivated by the Romans, and used chiefly as food for horses. In England, in the middle of the seventeenth century, it was commonly used as the food of the people because it grew readily in any part of the kingdom. Since improved means of transportation have brought all countries within a few days of each other, wheat is carried to lands in which it will not thrive, and people no longer need to live on the produce of their own soil. Barley has less starch and more cellulose, mineral matter, and fat than rice. It is largely used for the manufacture of beer, being better suited for it than the other grains. Its flavor should commend it to the intelligent consumer for more varied use.

### RICE

Perhaps no other food stuff has been so misrepresented as rice. On the one hand, it is often stated in

print and in conversation that rice is "only starch and has no nutritive value." On the other hand, the Chinese and Japanese and other East Indian people are said to "live on rice." It has been represented, in the case of the recent war, that the Japanese soldiers went through this strenuous campaign on rice.

This only illustrates the need of universal education in the matter of food values. Under the direction of Prof. W. O. Atwater this subject was thoroughly investigated by the United States government at the time of the Chicago Exposition with reference to several groups quartered in the Midway, especially in the case of the Java village. Other studies of the dietary habits of so-called rice-eating people have been made on the spot with the same general result, namely, that rice is found to take the place of bread, potatoes, and vegetables — in a word, furnishes the pound of starch a day which other nations take in a variety of forms.

Since rice contains only a small proportion of either fat or nitrogenous compounds, it cannot form the sole food of human beings for any length of time, but the great bulk of cooked rice has misled many observers, and caused them to overlook the concentrated nitrogenous food which always accompanies it. For instance, the Java village people brought with them potted fish roe to furnish in large degree the needed nitrogen. The Chinese in San Francisco import from China dried ducks' livers and hard-boiled ducks' eggs. All the peoples who have been investigated use meats, chicken, ducks, fish, or some other form of proteid supply. They do not use this in the wasteful excess in which

American communities usually revel, but in a sufficient quantity, as a rule. It is the fat which is more often lacking in their diet.

Rice is admirably adapted to serve as a conveyor of fat and proteid, in the form of cheese, for instance.

Different varieties show differing food values. The Japanese variety is richer in nitrogen substances.

The rice of commerce is the product of the grass *Oryza sativa*, probably a native of the East Indies, but cultivated in all portions of tropical and subtropical regions. It forms the principal food of nearly one-third of the human race, and enters largely into the diet of all civilized nations. It has been known in China for 5,000 years. The outer coat of woody fiber does not adhere closely and is easily removed, so that, as sent to market, the shelled grain is the inner or starch kernel. The wild rice of North America belongs to another genus, *Zinania aquatica*. It grows in the north temperate regions, and deserves more notice than it has hitherto received. Rice flour is now largely used in the adulteration of many finely ground foods and of condiments.

"History tells us that the first rice grown in this country was introduced in 1695 by the captain of a brig from Madagascar, who gave some seed to Governor Smith and his friends to experiment with, and the result has been an important industry. The rices which chance introduction had brought in were looked upon as the finest in quality in the world and were exported to Europe; but with the call for a whiter and more polished product than the hand-threshed rice of plan-

tation days came machine-polished rice, and the center of the rice industry was transferred to Louisiana and Texas by the discovery of artesian wells in those states.

"The machine-polished rice that we buy in this country today is, as every one knows, a truly beautiful thing to look at, but as tasteless as the paste that a paper hanger brushes on his rolls of wall paper. The leather rollers of the machine not only rub off all the fine outer layer of nutritious matter, and with it the part that gives flavor to the kernels, but they often break the long, slender grains that characterize the famous Carolina golden rice. This breakage is so great that the Louisiana growers begged for assistance, and the new Office of Plant Introduction sent Dr. S. A. Knapp to Japan in search of a short-kerneled variety that would not break in the milling process. Today Dr. Knapp declares that one-half of all the rice grown in Louisiana and Texas is the Kiushu rice that had its origin in the introduction made in 1899.

"This new rice has reduced the breakage from forty to ten per cent, and has at the same time brought into culture a more productive rice. It has not done away with the pernicious practice of polishing, but an interest in the unpolished rice has lately been aroused that, it is hoped, will lead to the abandonment of a practice which robs the buyer of nearly all of the flavoring matter of the rice and leaves only the starchy portion. It is a disgrace that the most intelligent nation in the world should be so ignorant of the food value of the crop on which more people live than on any other, that they should insist on having their rice

made as shiny as polished glass beads, although in so doing they are throwing away the best part of it. No rice-eating people treat their rice as we do, and it is to be hoped that the small markets that have been started for the unpolished rice will lead to a general propaganda in its favor."[1]

### OATS

Oatmeal is prepared from two species, *Avena sativa* and *Avena orientalis*, which belong to the same natural order as wheat. This grain grows best in a cool, moist climate. Its native country is not known with certainty. There is evidence that the plant was known in Britain in 1296, and mention is made of the use of oatmeal porridge as an article of food in 1596. In 1698 the consumption of oatmeal was second only to barley, but wheat has gradually taken its place in Southern England. By kiln-drying and removing the husk, groats or grits are obtained, which, when ground, yield oatmeal. The husk is not as completely removed as in the case of rice, and the meal is not as white as wheat meal. Although it contains a large proportion of nitrogenous matter, it is not in the form of the tenacious gluten of wheat; hence it will not make light or porous bread. Oatmeal is not as easily digested as wheat flour, and as a staple article of diet it is best suited to persons who are much in the open air; but a portion of the morning meal may advantageously be of this very nutritious grain. Blyth says that in England it is sometimes adulterated with barley meal.

[1] National Geographic Magazine, April, 1906.

### MAIZE

Maize (*Zea mays*) is remarkable in the order of grasses for the large size of its grains, and for the heads into which they are collected. It grows wild in the neighborhood of Mexico and in tropical America, and has now been introduced into every quarter of the globe, though it cannot be relied upon as a field crop in Great Britain. It has been said that what wheat is in Europe and rice in Asia, maize is in America.

Maize, or Indian corn, as it is called in the United States, was not much consumed in England until the year of the potato famine, in 1846, when hominy was imported. Now millions of pounds are annually imported, chiefly from the Black and Mediterranean Sea borders. It is the leading cereal crop in the United States, four times as much as wheat being grown. It is an excellent food, easily digested and very nutritious. It is much used for the preparation of starch and for "infants' foods." The starch is separated, and used in place of the more costly arrow-root. It is used in the manufacture of glucose, whisky, etc, and is fed to animals.

### RYE

As a food rye possesses advantages which entitle it to a more careful cultivation and a wider use. It is less irritating to the digestive tract than wheat, and its flavor in combination with other grains would give a greater variety of breads.

Rye (*Secale cerale*) is nearly allied to wheat. The grains are smaller, and the flour not so white. It is

very rich in nitrogenous substances. It grows a little farther north than wheat flourishes, and it thrives on a sandy soil too poor for any other grain. The bread made from rye flour is not so white and light as that made from wheat flour, but it is extensively used in Europe. The chief objection to its use is, that it is liable to be injured by a fungus, which produces an appearance like a spur, and which is called *ergot*. If these swelled grains are ground with the others, the flour is rendered unwholesome and even dangerous.

### WHEAT

Wheat flour is prepared from the seeds of *Triticum sativum*. The cultivation of wheat has superseded that of all other grains in climates where it will thrive (in the temperate zone as far as 60° north), but in the Middle Ages it was food for the wealthy classes only. Its use has been constantly on the increase, until it is now food for all classes.

The reason seems to be, that bread made from it has no unpleasant or pronounced taste, so that the most fastidious palate does not become weary of it, and has a light, spongy, or porous character, quite peculiar to the wheat loaf. This adapts it for ready digestion, and is due to the peculiar nature of gluten, which in good flour is very elastic, and when the moistened dough is compressed causes it to spring back again to its place.

The quality of the prepared flour is dependent upon the variety of wheat, the curing of the ripened grain, and the process of grinding.

There are two kinds of wheat, the hard and the soft, which are referred to in the description of the grinding.

The curing of wheat is of the utmost importance, for if the grain is allowed to become damp and moldy a disagreeable flavor will be communicated to the flour.

Among other quick methods of producing effects formerly gained only by time is that of aging flour by electricity. This bleaches the flours, and may permit of the admixture of a less white or lower grade flour. According to an advertisement in a recent issue of the *Modern Miller*, two-thirds of the flour manufactured in the United States is so aged. Such flour appears to give a test for nitrites by the method used for water.

For grinding two processes are used, which are known as high and low milling. In early times the kernels were brayed in a mortar, and later they were ground between stones. Low milling is a grinding between two large, round stones, one or both revolving at so small a distance from each other as to crush the kernels, which are caught, as it were, by radial grooves in the stones. The wheat is often moistened in grinding, as it is thought to be more readily crushed. The heat developed is considerable, so that the temperature of the flour as it comes from the stones is about 120° F. The heating, and the grinding of a portion of the husk so fine that it sifts with the body of the grain, are the chief objections to this method. It is thought that the heat may change somewhat the character of the gluten, rendering it less tenacious, and so the flour less fit for the making of light bread. The action is purely a single crushing, and was used for the softer kinds of wheat. High milling, which is a succession of

crackings, or of slight and partial crushings, alternating with sifting and sorting, is better adapted to hard wheat. There is also a mixture of the two processes called half high milling.

In general, the modern commercial process may be described as follows: The wheat is first cleaned, then passes to a series of cylindrical rolls arranged at distances so graded that when the wheat kernel passes between the first set it is merely cracked; then the fragments drop between the next set and are again cracked, and so on, each set pulverizing a little finer than the preceding one. In this way the husk is not bruised, only flattened out and loosened so that the dry starch granules drop out. The flour is not heated, since it is not subjected to friction, and since it falls through the cool air between each set of rolls. At each grinding the fine flour is removed by bolting, and finally all the different streams are blended to form different grades of flour. It is thought that the separation of the non-nutritious portion is also more complete, and hence that the flour is richer in the phosphates and nitrogenous substances which are found in the layer of cells next the husk. Since there are no particles of bran in the high-milled flour it is whiter, and since it has been ground dry it has less moisture and will keep longer.

Low milling yields about 80 per cent of flours of various grades, differing comparatively little from each other. High milling yields about 75 per cent of merchantable flour, 72 per cent being straight grade or ordinary white flour.

Flour for household use will perhaps average 70 per cent of starch and dextrin, about 7 per cent each of sugar, mineral matter, and cellulose, 1 per cent of fat, and about 15 per cent of albuminous or nitrogenous substances. These constituents are so proportioned as to render wheat flour a highly nutritious food, capable by itself of sustaining life and health.

"The durum wheat, from which the bread of the common people is made in Southern Europe and Russia, was almost an unknown thing on our grain markets until 1900; but today it is a living question in the milling centers of the Northwest. It is a wheat for the dry lands, where the ordinary kinds grow poorly or not at all, and it yields so much more per acre and is so much surer a crop that, even if it should not bring the highest prices, it will pay better than the less drouth resistant species which Western farmers have hitherto tried to grow on the dry farm lands of the Dakotas and Nebraska.

"Custom still fights the innovation of a new flour, and there are people who think our bread is in danger of being deteriorated by the new introduction; but they are not the well-informed who have tasted the full-flavored wheat breads of Spain or Italy, or who realize the great and growing future of macaroni as a food in this country. American-made macaroni, prepared with the best of the old American wheats, cannot be compared with the delicate products of a Gragnano factory. But with the culture of this durum wheat in America a change is coming, and the time may come when we shall ship macaroni to Italy instead

of importing it at the rate of nearly $2,000,000 a year. This innovation in the great wheat industry has been the result of the efforts of Mr. M. A. Carleton, who was sent to Russia as an agricultural explorer of the Office of Plant Introduction in 1898 and in 1900. The office has distributed thousands of bushels of the durum wheat varieties gathered by him from all the Mediterranean and South Russian countries where it is grown."[1]

The importance of good flour can hardly be overestimated, since upon good bread depends the health of the greater part of the human race in all temperate climates.

This is not the place to discuss physiological questions, or to take part in the war of words over graham, whole wheat, and fine flour. A discussion of the chemical side of the question will be found in the Thesis of Miss Charlotte A. Bragg, Technology Quarterly, vol. III, No. 3, 1890, from which the following extract is made:

"The following tables give in a condensed form the results of the analyses of the two samples of wheat, and the products derived from them. A balance sheet was deduced therefrom.

ST. LOUIS WINTER WHEAT

| | Water Per cent | Phosphorus Per cent | Nitrogen Per cent |
|---|---|---|---|
| Whole Wheat | 12.85 | 0.262 | 1.87 |
| Royal Patent | 13.37 | 0.051 | 1.39 |

[1] Our Plant Immigrants, by David Fairchild, in National Geographic Magazine, April, 1906.

| | Water Per cent | Phosphorus Per cent | Nitrogen Per cent |
|---|---|---|---|
| Extra Fancy | 12.51 | 0.100 | 1.78 |
| Low Grade | 11.94 | 0.100 | 2.08 |
| Middlings | 11.21 | 0.225 | 2.73 |
| Bran | 12.15 | 0.828 | 2.62 |

MINNESOTA SPRING WHEAT

| | Water Per cent | Phosphorus Per cent | Nitrogen Per cent |
|---|---|---|---|
| Whole | 11.09 | 0.230 | 2.24 |
| Patent | 12.29 | 0.050 | 2.10 |
| Bakers' | 12.14 | 0.091 | 2.40 |
| Low Grade | 11.47 | 0.192 | 2.59 |
| Shorts | 11.27 | 0.560 | 2.78 |
| Bran | 11.23 | 0.830 | 2.55 |

"The balance sheet defines the position of fine white flour very clearly. It shows that hard spring wheat gives a flour rich in nitrogen, 69.5 per cent of the total being saved in the three grades of flour. Winter wheat does not show quite as well; not only is there more bran, but it is richer in nitrogen. Nevertheless, 62.2 per cent of the total nitrogen is saved. There is, therefore, no need to eat whole wheat bread in order to obtain a food rich in nitrogen.

"Quite another story is told by a study of the proportion of phosphorus. The two varieties of wheat more nearly approach each other, but the spring wheat loses 79.6 per cent and the winter wheat 77.8 per cent of its total phosphorus. Here, then, is the bone of contention. The fine white flour is sadly deficient in phosphorus, but is the phosphorus which is contained

in the bran available for human food? According to the latest experiments of Professors Voit and Rübner in Munich, it would seem that not only is the bran quite indigestible, but that by its irritating action it causes a loss of both nitrogen and carbohydrates, which would be available in its absence.

"It would seem, therefore, fair to conclude that the bread made from fine flour, which is most tempting to eyes and palate, may, after all, be the one best adapted to the needs and conditions of the human system."

Since the amount of gluten in a flour often has an interest for the housewife beyond that of nutritive value, a means of estimating it is often called for.

Wiley (Agricultural Analysis, vol. III, p. 435) gives the following as a method for separating crude gluten from flour: Ten grams of flour (or one-half an ounce may be taken) are well moistened with a nearly equal weight of cool water (not over 60° F.), worked into a ball, and allowed to stand an hour. It is then kneaded in a stream of cold water until the starch and soluble matter is removed. It may be weighed moist as a rough comparison with other flours.

### BUCKWHEAT

Buckwheat (*Fagopyrum esculentum*) a native of Central Asia, does not belong to the grasses or cereals, but to the family *Polygonaceæ*, which includes rhubarb and dock. It grows as far north as 72°, and thus stands next to barley. It matures very quickly — in one hundred days — and thrives on sandy soil. It is probably a native of Asia, and is largely grown in temperate

countries. The seed, when stripped of its indigestible husk, which composes about 20 per cent of it, is rich in food material. It is often adulterated with cheaper flour. Of 107 samples examined by Winton in 1900, twenty-six contained wheat flour or middlings, nine maize flour, and nine contained them both. The prepared or self-raising buckwheats are usually mixtures of flours with baking powder.

### STARCHES, ETC.

The prepared starches are purified, so that they contain little else than pure starch, and thus are not capable of sustaining life by themselves. Starch may be derived from the cereal grains mentioned before, or from tubers or roots, as the potato, arrowroot, and manihot or yucca, which yields farina and tapioca, and from the stems of plants, as the sago palm.

Cornstarch is much used in the United States as an article of diet. Farina is another name for a preparation from the starch of maize or wheat, which now takes the place of the farina of manihot.

Genuine macaroni, spaghetti, and vermicelli are made from wheat rich in gluten, and hence are nutritious, but not more rich than some other wheat preparations. Imitations are made from a less rich flour colored with saffron or other yellow coloring matter.

Arrowroot is derived from plants of the genus *Maranta*, of the West India Islands and tropical America, the chief species being *M. arundinacea*. The earliest recorded notice of the plant, the knowledge of which was obtained from South American

Indians, refers to the supposed virtue possessed by its roots as an antidote to poisoned arrows; and it probably derives its name from this. Arrowroot was introduced into England about the beginning of the last century; but its use has been largely superseded by that of cornstarch.

INFANTS' AND INVALIDS' FOODS[1]

| | Starch, fiber, etc. | Maltose. | Lactose. | Cane sugar. | |
|---|---|---|---|---|---|
| Imperial Granum . . . | 76.60 | . . | . . | . . | Wheat starch |
| Ridge's Food . . . . | 72.01 | . . | . . | . . | Wheat starch |
| Mothers' Food . . . | 69.24 | . . | . . | 3.00 | Corn and wheat starch |
| Robinson's Barley . . | 78.66 | . . | . . | . . | Barley starch |
| Horlick's Malted Milk | 15.68 | 49.00 | . . | 8.00 | . . . . |
| Lactated Food . . . | 47.72 | . . | 30.00 | Trace | Wheat starch |
| Mellin's Food . . . . | . . | 50–60 | . . | . . | Soluble dextrin |
| Nestlé's Milk Food . . | 35.34 | . . | 8.96 | 36.34 | Wheat starch |
| Reid and Carnrick's Baby Food . . . . | 34.54 | . . | 30.00 | 8–9 | . . . . |

These foods for infants and invalids need attention on account of misrepresentations and the fact that physicians ignorantly prescribe, or at least do not forbid the use of, those which are far from what they profess to be. Some of them are simply starchy mixtures, more or less cooked, but not converted.

The milk foods are dried milk, usually too low in fat, Nestlé's Food being the only exception.

Mellin's Food is the only food which does not contain starch, but this is too low in fat and should be given with cream.

[1] McGill, Canadian Department of Inland Revenue, Bulletin 59.

Horlick's Malted Milk, Lactated Food, and Reid and Carnrick's Baby Food are mixtures of which the first has the least starch.

### BREAD AND CRACKERS

Bread and crackers are so largely purchased that attention should be given to clean manufacture. A poster recently displayed showing a boy and girl hugging in their arms several loaves of unwrapped bread, some of which must fall to the ground before many steps, illustrates the careless handling of cooked foods. There is far more danger to health in this direction than in the possible use of alum or ammonia by a few bakers.

The light weight loaf, "proofed" to an excessive size, furnishes less nutrition than the buyer supposes.

The cracker manufacturer needs to be watched as to quality of ingredients and care in handling, especially since his products are so largely used by children.

COMPOSITION OF THE PRINCIPAL CEREAL GRAINS TABULATED BY VILLIER AND COLLIN[1]

| | Wheat. | Barley. | Rye. | Oats. |
|---|---|---|---|---|
| Water | 13.65 | 13.77 | 15.06 | 12.37 |
| Nitrogenous substances | 12.35 | 11.14 | 11.52 | 10.41 |
| Fat | 1.75 | 2.16 | 1.79 | 5.32 |
| Sugar | 1.45 | 1.56 | 0.95 | 1.91 |
| Gum and dextrin | 2.38 | 1.70 | 4.86 | 1.79 |
| Starch | 64.08 | 61.67 | 62.00 | 54.08 |
| Cellulose | 2.53 | 5.31 | 2.01 | 11.19 |
| Ash | 1.81 | 2.69 | 1.81 | 3.02 |

[1] Leach, Food Inspection and Analysis, p. 212.

| | Rice. | Corn. | Millet. | Buckwheat. |
|---|---|---|---|---|
| Water | 13.11 | 13.12 | 11.66 | 12.93 |
| Nitrogenous substances | 7.85 | 9.85 | 9.25 | 10.30 |
| Fat | 0.88 | 4.62 | 3.50 | 2.81 |
| Sugar | 16.52 | 2.46 | 65.95 | 55.81 |
| Gum and dextrin | | 3.38 | | |
| Starch | | 62.57 | | |
| Cellulose | 0.63 | 2.49 | 7.29 | 16.43 |
| Ash | 1.01 | 1.51 | 2.35 | 2.72 |

# CHAPTER VI

## SUGAR

THE word *sugar*, probably of Sanskrit origin, is now used to designate a class of substances possessing a sweet taste and capable of breaking up into alcohol and carbon dioxide under the influence of ferments, such as yeast.

Common sugar is called cane sugar, because it is obtained principally from the sugar cane, a tall grass, *Saccharum officinarum*, a native of Southern Asia. It is the sweetest of all the sugars, and is technically called *sucrose*. It has been known from the earliest historic times. Some early writers spoke of it as "honey made from reeds without bees."

According to Albertus Agnensis, as stated by Muspratt, in the time of the Crusades sweet honeyed canes were found in great quantity in the meadows near Tripoli in Syria, which reeds were called *zucra*. The plant was cultivated, and when ripe it was bruised in mortars, the strained juice set by in vessels "till concreted in the form of snow, or white salt; this, when scraped, they mix with bread, or rub it in water and take it as pottage, and it is to them more wholesome and pleasing than the honey of bees."

The sucrose of commerce is also obtained from the beet, the palm, and the maple tree, and from another grass, *Sorghum saccharatum*.

The sugar cane contains about 18 per cent of sugar. The canes are crushed and passed through powerful presses. The juice is boiled in vacuum pans with a little milk of lime, added to neutralize the acids which the juice contains; this forms a scum, which is taken off. After the boiling has concentrated the juice sufficiently, it is run into a large vessel to crystallize.

The mass of crystals formed is drained from the syrup, and is known as raw or muscovado sugar. The non-crystallized portion is known as molasses.

This boiling down in vacuum pans has deprived the housewife of the old-fashioned West India or New Orleans molasses, with which she made such delicious gingerbread, which even "mother" can no longer prepare. The acid molasses produced by the slow evaporation of the sugar cane juice in open pans is to be found only rarely and in small quantity on the market. In 1903–04 only 27,964,292 gallons of molasses were produced in the United States as against 37,000,000 gallons in 1902–03.

The grades of sugar also have changed very much. The dark brown sugars have almost disappeared from the market. This is owing to the improved methods of boiling. The granulated is of the same quality as loaf sugar, only the syrup is stirred while crystallizing, so that the crystals do not cohere. The light brown sugars are the next product, containing some molasses, and therefore they taste sweeter, since the flavor is more pronounced in the colored portion of the juice.

If the granulated sugar is not quite freed from the

syrup, it tastes more decidedly sweet than if it is perfectly pure. That is, it has more the taste which we are accustomed to associate with sugar.

It is often said that powdered sugar must be adulterated, because it does not sweeten as much as loaf sugar; but such is not the case, and some explanation must be sought. The reason seems to be twofold: first, a spoonful of powdered sugar does not weigh as much as a spoonful of granulated; second, since sweetness is a physical property, the finely divided condition of the sugar has something to do with it. The coarser grains seem to excite in the nerves of taste a stronger vibration, so to speak, in dissolving than do the fine particles. To prove this, equal weights of loaf, of granulated of different degrees of fineness, of powdered, and of coffee-crushed sugar were dissolved in equal volumes of water and then tested by various persons, the tumblers containing the solutions being numbered, so that the taster was an unbiased judge. Some pure honey was added to the list, and the results confirmed the previous suspicions that the taste was not due to the chemical purity of the substance. In every case the coffee sugar was pronounced the sweetest, and that of the solution of honey the least sweet. As to the solutions of the other sugars, which were all pure sucrose, judgments varied, showing that the sensation of sweetness is not owing solely to the presence of a certain amount of sucrose.

That beet root contained a sugar identical with that obtained from the sugar cane was first made known by Margraf in 1747. But the beet was not cultivated

for the purpose to any extent until the middle of the last century. Under the protection of Napoleon I., the industry gradually gained ground. A prize of a million francs was offered for the successful manufacture of sugar from plants of home growth. As late as 1860 the fate of beet sugar was doubtful, since the disagreeable flavor of the molasses still clung to the crystallized sugar. But applied science has overcome all the difficulties. The purest loaf sugar is now made from beets, and there is produced one and one-half times as much beet sugar as cane sugar. The total amount of beet sugar produced in 1840 was 50,000 long tons. The total amount of cane sugar produced in 1840 was 1,100,000 long tons. The total amount of beet sugar produced in 1905 was 6,990,000 long tons. The total amount of cane sugar produced in 1905 was 4,908,000 long tons.

The culture of the beet has spread throughout Germany and Russia. It has been tried in England, Ireland, and the Northern United States, and is proving a source of profit in many latitudes where the sugar cane will not thrive. Beets contain up to 10 or 12 per cent of sugar. In Belgium and France they extract about 7 per cent, and in Germany 8 or 9 per cent. The process of manufacture differs little from that of cane sugar. The molasses from beet sugar is mostly sent to the distillery, as it has a very disagreeable taste.

In parts of the United States and in Canada sugar is made from the sap of the maple, *Acer saccharinum*, and other allied species. The sugar is cane sugar, or

sucrose, and the accompanying substances in the sap give an agreeable flavor quite peculiar to maple sugar. Several million pounds are annually produced.

The cultivation of the Chinese sugar grass, or sugar millet (*Sorghum saccharatum*), has been attempted in the United States, with some success. It seems to be suited to a warm temperate zone, and thus is intermediate between the northern maple and beet and the tropical sugar cane. It is used largely for fodder, however.

The term sugar, as used today, is a very general one covering a wide range of substances, the number of which is constantly growing by virtue of chemical research.

The housewife has to do with two of the great groups:

1. The monosaccharids ($C_6H_{12}O_6$), or glucoses. At least fifteen are named, to which belong grape sugar (dextrose), crystallizable; fruit sugar (levulose), non-crystallizable; and invert sugar, a mixture of the two (made from the sucroses by boiling with acid).

2. The disaccharids ($C_{12}H_{22}O_{11}$), or sucroses. To this class belong cane sugar, or sucrose, beet sugar, maple sugar, malt sugar (maltose), and milk sugar, or lactose.

The sugars are often divided into *reducing* (those which reduce copper from copper sulphate), maltose, lactose, invert sugar, dextrose, levulose; and *nonreducing*, as cane sugar, beet sugar, maple sugar.

Starch is a polysaccharid, along with cellulose, dextrin, glycogen, and pectin. It can be considered as

an aggregation of 100 groups derived from dextrose, $C_6H_{12}O_6$ (100 $C_6H_{10}O_5$), by the removal of water from each during plant growth. These water molecules may be replaced and sugar again formed by treating with acid (artificial or unnatural) or by the action of an enzyme, as diastase, the natural ferment found in barley in abundance.

In the acid hydrolysis the starch breaks up gradually into maltose, a dextrin, and dextrose. In the enzyme treatment only the first two result as a rule.

Much confusion is caused by the loose way in which the term "glucose" is commonly used. Formerly it was the designation of all the manufactured products, whether solid or viscous, but of late the term "starch sugar," or dextrose, covers the solid sugars and glucose means the syrup form, from the Greek *glukus*, meaning sweet.

While all kinds of starch, and even cellulose, will yield starch sugar when treated (hydrolyzed) with acid, corn is the chief source. The grain is soaked in huge vats, holding some 2,500 bushels, in warm water for several days. Sulphur dioxide is added to sterilize and to soften the hulls. The grain is then ground, and the starch is washed through bolting cloth sieves and allowed to settle. If it is desired to save the germ, a first coarse grinding allows it to float away and a second finer grinding sets free the starch grains.

The collected starch, mixed with water to a creamy consistency, is run into copper boilers with about six pounds of hydrochloric acid to each 10,000 pounds of starch. It is heated under pressure of some thirty

pounds and drawn off, decolorized, and refined in much the same manner as the juice of the sugar cane.

The demand for starch sugar for candies and jellies, and of glucose for syrups, has caused an enormous production in this country, irrespective of its use in beers.

Confectionery is usually preferred in a soft or amorphous condition; rock candy or crystallized sugar is rarely called for. It is for this reason that sugar for making candy is inverted, or changed into reducing sugar (mixture of dextrose, or grape sugar, and levulose or fruit sugar), by boiling with some acid, usually cream of tartar or tartaric acid.

The "fondant" of chocolate creams and bonbons may be made in this way. Gums and starch pastes, even clay, may be used to dilute the crystals of sugar and keep the mass agreeably soft, but commercial glucose is easier to work, healthful, cheap, and pure, therefore is largely used in modern candy making. The pastes and cheap gum drops are made of starch, paste, and glucose. Marshmallows have gelatin added.

It requires two and one-half times as much glucose as cane sugar to sweeten the same volume of water. This may partly explain the increasing pounds of candy consumed.

Grape sugar is present in the sacs of flowers, and is the source of honey. It can be readily obtained from grapes by expressing the juice, and after neutralization of the acids the syrup may be refined and crystallized as in the case of beet sugar, but it crystallizes with difficulty and is apt to take on water and become moist.

It is accompanied by the non-crystallizable sugar, levulose. Grape sugar made from grapes is too costly for ordinary use. In jellies and preserved fruits a large portion of the cane sugar, or sucrose, is changed into glucose during the heating with the acid juice of the fruit.

The following table[1] shows the proportion of sugars and acid in various fruits:

| | Cane sugar. | Reducing sugar. | Acid. |
|---|---|---|---|
| Apricots | 6.04 | 2.74 | 1.864 |
| Pineapples | 11.33 | 1.98 | 0.547 |
| English cherries | 0.00 | 10.00 | 0.661 |
| Lemons | 0.41 | 1.06 | 4.706 |
| Figs | 0.00 | 11.55 | 0.057 |
| Strawberries | 6.33 | 4.98 | 0.550 |
| Raspberries | 2.01 | 5.22 | 1.380 |
| Gooseberries | 0.00 | 6.40 | 1.574 |
| Oranges | 4.22 | 4.36 | 0.448 |
| Peaches (green) | 0.92 | 1.07 | 3.900 |
| Pears (Madeleine) | 0.36 | 8.42 | 0.115 |
| Apples | 5.28 | 8.72 | 1.148 |
| Apples | 2.19 | 5.45 | 0.633 |
| Prunes | 5.24 | 2.43 | 1.288 |
| Grapes (hothouse) | 0.00 | 17.26 | 0.345 |
| Grapes (green) | 0.00 | 1.60 | 2.485 |

Not only may sucrose be converted, but all woody fiber or cellulose can be acted upon by acids so as to form glucose; hence any woody substance, as sawdust, cotton, etc, can be converted into glucose; but this is not done for the purpose of sugar manufacture, since corn meal is much more available. Such waste product may be used for spirits.

[1] Buignet (Ann. Chim. Phys., 59, p. 233), taken from Leach, p. 462.

Milk sugar, or lactose ($C_{12}H_{22}O_{11}$ $H_2O$), is prepared from skim milk, a waste product of the dairies. The sugar of milk is a valuable product for use in the preparation of modified milk for infants; in medicine it is of importance as an excipient, or vehicle for active remedies; and in certain diseases it is a valuable nutrient.

There is little probability that the use of milk sugar will ever become as universal as that of the other forms of sugar, for the price, from twenty to forty cents a pound, is prohibitive.

The chief adulterants to be looked for in milk sugar are grape sugar and cane sugar.

### HONEY

The United States produces the most honey, the annual production as reported in 1900 being 61,196,160 pounds.

It is said, especially by English analysts, that much American honey is entirely artificial, that the comb is made of paraffin and filled with glucose syrup. Two simple tests will show whether this is the case. Normal honey, being collected by the bees from flowers, will contain many pollen grains. The absence of these is a suspicious circumstance. Beeswax is blackened by warm sulphuric acid, while paraffin is not affected.

The most common adulterants of honey are cane sugar and commercial glucose. Gelatin is also found. Sometimes bees are fed on cane sugar or glucose, which is placed near the hives. In such a case they may supply the adulterants.

The presence of the comb in honey is by no means

a proof of genuineness. In at least one sample the Massachusetts State Board of Health found pieces of artificial comb and a dead bee in a mixture of glucose and cane sugar.

In the Bulletin of the New Hampshire Board for July, 1906, a table is given showing that out of thirteen samples examined, only seven were of legal quality.

### ADULTERATION

The adulteration of sugar may be considered under three heads. First, the addition of insoluble substances, such as marble dust, which is sometimes found advertised among the supplies of confectioners. It is said that sand used to be added. Second, the foreign substances left in from the process of manufacture, such as ultramarine, to give the requisite blue color. If tin were ever found in sugar, it would be in this list. Third, and most frequent at present, is the addition of glucose, or corn sugar, which is much cheaper, but is less sweet, partly on account of its lesser solubility in water. One quart of water dissolves three pounds of cane sugar, but only one or one and a half pounds of grape sugar.

Sugar may be so manipulated in refining as to be white and crystalline, and yet contain quite a percentage of moisture and syrup. Such sugar cakes together on standing. The presence of this moisture may be regarded as an adulteration.

The adulteration of the granulated and powdered sugars, at least those sold in the Eastern States, is not as extensive as has been supposed. Of the sam-

ples examined by the writer in 1879, not one of seventy-three samples from Massachusetts, not one of five from New York, and only one of twelve from Chicago was adulterated.

Today (1906) granulated sugar is probably the purest food product on the market.

Syrups, on the contrary, are very liable to be *not* what they seem. Dr. Kedzie, of Michigan, in 1879 found only one out of twenty-one genuine.

The Kansas Board of Health, in its Bulletin for June, 1906, states the percentage of adulteration in maple sugar and syrup as 95.8.

The July Bulletin from New Hampshire, the home of the sugar maple, gives only twenty-one samples of legal quality out of forty-one examined.

The usual adulterants of maple syrup are golden or drip syrup, commercial glucose, molasses, and refined sugar.

The ordinary table syrup is chiefly glucose or corn syrup.

## CANDY

The enormous extension of the candy trade demands attention both from the hygienic and the economic point of view. Some years ago Professor Simon N. Patten warned us that we were being eliminated on a sugar diet — women particularly. With the best granulated sugar at say six cents a pound, and commercial glucose at about half that price, the sale of candies at forty to eighty cents means large profits, which are to a great extent used up in fancy boxes, high rents, and expert

service, so that even at fifteen cents a pound it is possible to sell candies where other expenses are low. A large part of the tons of candy purchased by the young people of our towns is glucose more or less bleached by bisulphite of soda. Commercial glucose of the unrefined sort as it comes from the factory to be used, in beer, for instance, has a yellow cast, and would not sell so readily; hence the bleaching. Glucose itself is a good food, but the sulphites are not exactly wholesome.

The fancy for brilliant colors in food finds full play in candies. Some 200 coloring substances are named in the National Confectioners' Association list, of which about one-third are recognized as harmful. Mineral colors, such as lead chromate (yellow), formerly frequent, are rarely seen. Coal tar dyes, from their intense coloring power, are generally used. The quantity taken at any one time is almost infinitesimal.

Cheap candies are sometimes stuffed with starch, paste, and paraffin, and the fats used are of doubtful sources. "Brandy drops" containing fusel oil and alcohol ought to be driven from the market.

In 1900 thirty-one out of seventy-eight samples of confectionery examined in Massachusetts were adulterated. Chocolate brandy drops gave in some cases more than 4 per cent of alcohol.

The Inland Revenue Department, Ottawa, Canada, reports the following results of an examination of highly colored confectionery, samples having been collected during two months: Out of fifty-six samples examined thirty-four contained two colors, twenty contained three

colors, and two contained four colors. In but one sample was the presence of arsenic shown, and that in such minute quantity as to be completely harmless.

### USES OF SUGAR

In Europe it was used only in medicine until about the fifteenth century, and it was not produced in large quantities till about 1800. Only within a few generations has sugar been used as a food, and produced in sufficient quantities to bring the price within the reach of all classes of people. The consumption of sugar is everywhere increasing. In 1899 the total consumption was from seven to eight million tons. In 1904 it was from eleven to twelve million. In the United States alone it was nearly three million, having increased from eight pounds a head in 1825 to 75.3 pounds in 1904.

Until recently, taking the world as a whole, it might be said that sugar was used as a condiment rather than as a food, but at present it seems a very important article of diet, and should be so considered. It would seem that in the north it is taking the place of the starchy foods that sometimes can be obtained only with great difficulty. It is known that the consumption of sugar is large among American farmers and lumbermen. In Switzerland loaf sugar and very sweet chocolate are important elements in the outfits of mountain climbers, and on all polar expeditions sugar is considered an essential. Undoubtedly it is an invaluable as well as an agreeable food for these dwellers in the open air.

Professor Pflüger is quoted as saying that without doubt the sugar in the blood is heavily drawn on during

violent exercise; hence the longing for it in a form that can be readily assimilated.

In Mrs. Abel's Bulletin, "Sugar as Food,"[1] may be found exceedingly interesting accounts of experiments by Mosso and Dr. Schumberg in lessening fatigue by means of cane sugar. A short quotation is in place here: "In effect Dr. Schumberg says, 'The practical conclusion to be drawn is that sugar in small doses is well adapted to help men to perform extraordinary muscular labor.' He advises practical tests of his results on a large scale, in which small amounts of sugar in some refreshing drink, as lemonade, will be given to men fifteen or twenty minutes before they begin a piece of very hard work or at the first signs of exhaustion. If the sugar is to be taken in solid form he recommends chocolate as the best medium. The application of these results to the food of soldiers who may be called upon for extraordinary exertion in marching or fighting is very evident."[1]

In warm countries, where little fat is eaten, sugar as it is found in fruits forms a large portion of the food. It is said that in India the workmen must have each day a large amount of food that is well seasoned with sugar.[1] In all tropical lands the natives live largely on dates, figs, and other fruits that have a high percentage of sugar.

The growing opinion seems to be in favor of its moderate use. It is true that if the stomach is not able to digest it at once it is liable to change into lactic acid instead of being absorbed into the system. This

[1] Farmers' Bulletin No. 93.

only shows that sugar is not suitable for that individual at that time. The very general craving for sweets is undoubtedly founded on a law of demand of the system. Hence a moderate use of it by children is not to be rashly condemned. Like all other foods, sugar may be abused. That it plays a part as a heat-giving food is indicated by the fact that it is not craved to so great an extent in summer as in winter.

# CHAPTER VII

## NUTS

ONE class of food material worthy of further study from various standpoints has recently come into prominence. "Nuts as Food"[1] is the title of one of the excellent Farmers' Bulletins.

Certain facts about these products have been known without attaching due significance to them.

The plebeian peanut has been rescued from the upper gallery, and as "butter" has found its way to the most exclusive afternoon tea, as well as to the vegetarian bill of fare, and as "brittle" is a favorite candy. The pine nut, supposed to be a last resort of the starving Indian, is now imported and deprived of its content of turpentine for the delicate feast of devotees of uncooked foods.

Nut cakes, nut salads, nut ice cream, etc, all show the new direction in which public taste is tending.

These nuts are quite different from the most prominent variety of forty years ago, which was the cocoanut. This is today less frequently seen in our markets, being prepared nearer the place of production. Pecans are, for the time, the most abundant, and are worthy of the favor given them.

The composition of nuts is given as follows:

[1] Maine Experiment Station, Bulletin No. 54.

| | Edible Portion. | | | | | Refuse as purchased. | Cost per pound. |
|---|---|---|---|---|---|---|---|
| | Water. | Proteid. | Fat. | Carbohydrate. | Fuel value. | | |
| | Per cent. | Per cent. | Per cent. | Per cent. | Per pound. | Per cent. | Cents. |
| Brazil nut | 5.3 | 17.0 | 66.8 | 7.0 | 3,329 | 49.6 | 12 |
| Pignolia | 6.4 | 33.9 | 49.4 | 6.9 | 2,842 | . . | . . |
| Filbert | 3.7 | 15.6 | 65.3 | 13.0 | 3,432 | 52.1 | 15 |
| Hickory nut | 3.7 | 15.4 | 67.4 | 11.4 | 3,495 | 62.2 | 9 |
| English walnut (California bijou) | 2.5 | 18.4 | 64.4 | 13.0 | 3,305 | 73.1 | 15 |
| Pecan | 2.7 | 9.6 | 70.5 | 15.3 | 3,566 | 46.3 | 15 |
| Almond (California) | 4.8 | 21.0 | 54.9 | 17.3 | 3,030 | 45.0 | 15 |
| Peanut | 1.6 | 30.5 | 49.2 | 16.2 | 2,955 | Av. | 7.3– |
| Roasted | | | | | 3,177 | 28.0 | 14.6 |
| Chestnut (average) | 42.7 | 6.5 | 6.3 | 43.1 | 1,188 | 16.0 | 8.4 |

A glance at this table will show the high food value of nuts, and will explain why they may take the place of meat in the dietary.

Since nuts belong to the class of foods that are put up to keep, that is, with little water, they may be transported and used months after ripening.

They are not as yet liable to adulteration, and their quality is evident to the experienced buyer.

The United States furnishes a great variety of nuts, and the few not grown here are imported in quantity, Brazil nuts and filberts forming the bulk of the latter class.

The Brazil, or Para, nut grows on a large tree found in the Amazon forests (*Bertholletia excelsa*). It is sometimes incorrectly called castanea nut.

The filbert, or hazel nut (*Corylus tubulosa L.*) is

more used in Europe than in America, both for the table and for oil, of which it contains a surprising amount for so dry a nut.

Pignolias, the seeds of pine, are increasing in favor, particularly the Egyptian varieties, although several excellent varieties of pine nuts are grown in the southwest.

The pecan is a tree native to the United States (*Hicoria pecan*), growing from Iowa to Texas, where the greater proportion is raised. Its thin shell, being easily removed, makes it a great favorite.

The English walnut (*Juglans regia L.*) is an Asiatic tree introduced into England in the middle of the sixteenth century. It is now most successfully grown in California, the 1898 crop being estimated at eight million pounds. The black walnut and butternut are seldom found on the market, although both furnish edible nuts.

The chestnut (*Castanea sativa Mill.*) is a well-balanced food material, and the tree grows in most temperate lands. This nut furnishes a staple article of diet for the poorer classes along the Mediterranean, being made into puddings, cakes, and bread. Flour or meal made from it might easily replace many other meals in the diet.

The cocoanut palm (*Cocos nucifera L.*) furnishes food, oil, fiber, and adulterating material, especially for ground spices. Various preparations of the oil have been introduced as lard substitutes.

The pistachio tree (*Pistacia vera L.*) is said to have been cultivated in Egypt in the time of Joseph, and is now found mostly along the borders of the Mediter-

ranean. Other nuts, such as almonds, are sometimes dyed with coal tar dyes to imitate pistachios.

The almond is not a nut, properly speaking, but a drupe, or stone. The almond tree (*Prunus amygdalus Stokes*) is supposed to be a native of Turkestan and closely related to the peach. It is now naturalized in California. The table variety is the sweet or paper-shell. Variety *amara* furnishes the oil of bitter almonds. Other stones are not commonly substituted.

The peanut (*Arachis hypogæa L.*) is probably a native of Brazil, but is grown in nearly all temperate and subtropic regions. It is not a true nut, but grows in a pod on vines, and is one of a small group of legumes which bend the flower stalk until the young fruit is buried in the soil to ripen there. The American crop is four million bushels or more, about one-seventh of the world's product. In Europe the oil is used instead of olive oil for a salad oil, and makes an excellent substitute.

The olive (*Olea Europæa*) has been grown in California only from the time of the early Mission fathers, but has attained the proportions of a profitable industry. Some seventy varieties are grown in the State. Olives are sometimes partly dried before crushing in the old-fashioned stone mills for the extraction of the oil. The watery product is allowed to stand for perhaps a month and the clear oil is decanted. This process is claimed to give a delicacy of flavor which the filtered oils lack. The green olives gave on analysis 13 per cent of fat, while the ripe fruit gave 25.5. The oil may be eaten with bread instead of butter.

Today "salad oil" is derived from many sources

besides the olive. Cotton seed oil and corn oil are most frequently used, but other seed oils and peanut oil are found in European samples. The label in more or less correct Italian does not prove the contents of a bottle to have come from the sunny land. At present a great deal of the salad oil has never crossed the seas, but is known to the dealers for what it is, cotton seed oil. The oil is pressed out from the cotton seeds by powerful presses and makes a very clear, sweet oil, just as wholesome, for aught any one knows, as the oil pressed from the olive, and for home use it is certainly much cheaper. The trouble with the sale of it is, like that of oleomargarine, that it is sold under false pretences and for an exorbitant price.

In America the cereals are grown so freely and are prepared by machinery so easily that nuts cannot compete in price; but there are compensations, since nuts may be used without cooking, and also since the fat they contain makes them a more valuable food.

In comparing the cost of nuts with the cost of cereals, the difference in food values must not be lost sight of. Cereals are largely starch. Nuts in general are rich in fat, and therefore pound for pound have approximately twice the food value. The content in proteid of nuts is also higher as a rule than in cereals, and in the peanut more than twice as much. The proteid of nuts seems to be in a very digestible and utilizable form. It should be remembered that nuts are the form of food best suited to replace meat. This is made clear from the comparison in the table. The price should, therefore, be compared with that of meat rather than with that of cereals.

# CHAPTER VIII

## PERISHABLE FOODS — MEAT, POULTRY, FISH

MEAT is a form of food which requires very little expenditure of force for its assimilation, since that work was done by the animal when living, and man avails himself of it. Rightly used, it forms a valuable addition to man's diet. The consumption of meat has steadily increased in spite of the increase in price, which in England is said to have risen 35 per cent in the last twenty-two years. The amount consumed each day varies from one-tenth of a pound to two pounds a head.

Since meat contains 40 to 50 per cent of water and moisture is the prime requisite for the development of bacteria, it is readily seen that meat is nearly as perishable as milk, which has only 10 to 15 per cent more of water.

Butcher's meat as it has been obtained in small communities was the last food to be suspected. But, as in the case of milk, the concentration of population on small areas has necessitated the transportation of raw or frozen meat and poultry long distances, and the keeping of large quantities for weeks or months. People insist on living so crowded together and have developed such an insatiable appetite for meat that the local abattoirs are unable to supply the demand, and a large

part of any meat supply, even in the country, comes from the great packing houses of the Middle West.

Recourse must be had to the wild lands of the semi-arid regions for ranches, and large packing houses must be placed within reach of the ranches in order to save the transportation of so much live weight; for an animal when dressed shrinks to less than half its weight, and of this no more than one-half goes as meat to the city markets.

The various reports on the packing houses and the discussions of them in the papers have brought the question so vividly before the country at large that there is no need of repeating it here.

It is the demand for meat and the necessity for its long transportation, together with an unwillingness to pay the price of cleanliness (as in the case of milk), which has led to abuses now in a fair way to be remedied.

There is danger, however, of the public relying on the crusade against unclean methods of packing to give a safe product on the table.

Perishable foods must be guarded from start to finish if they are to be eaten with safety. The meat must be kept clean from the time it leaves the packing house until it reaches our tables. The retail meat dealer should have means to keep uncontaminated the stock of meat that he gets from the wholesale dealer.

In the few cities where public-spirited women have looked into the markets there have been revealed low standards of sanitation as bad as anything published about the packing houses.

Another danger is from the exposure of meats in warm weather to flies. In spite of cook books, meat from the open market ought to be washed (not soaked, but washed clean), and then dried with a cloth. But if the meat is kept under cover on a counter the storage place must be ventilated, since decay sets in sooner in the warmer, close air.

In cleaning meat, all creases and flaps should be carefully looked to and clots of blood removed, for such harbor the organisms of decay. In institutions, boarding houses, and kitchens where much work goes on the tendency is to neglect such matters.

One precaution must be given: Such washed meat should be put at once into the pot or oven, since a watery surface that favors bacterial action is substituted for the dried film of the long exposed surface. A case of severe illness known to the author was undoubtedly caused by the washing of pieces of fowl for fricassee the night before they were cooked and leaving them packed in a mass.

Protection against diseased meats we must leave to the inspectors, for this should be done at the time of killing, or again in the large markets. In this matter the people should be protected from the greed of any dealer as well as from accidental overlooking of cases.

Cooked meats exposed for sale should be always kept from flies, since such are not washed before eating.

The housewife's duty is concerned not so much with the packing house, but rather with the whole period, from the time when the meat leaves the cold storage and is exposed for sale till it reaches her own refrigerators and cooking vessels and is served on her table.

In the market she can insist upon cleanliness in handling, can agitate the matter of hot water for cleaning the hands, can see that non-absorbent paper is always used, that there is a quick removal of all waste, and the shortest possible exposure of raw surfaces.

If the slaughter house were as aseptic as a hospital operating room, and if the meat were placed in the refrigerator car in a perfect condition, it would not, with present careless and ignorant habits, come to our tables in a fresh condition. Some change goes on during the long journey even in the cold. The warm, dusty air of the meat market where it is exposed for sale, the dirty hands coming in contact with it in a dozen ways before it reaches the consumer's kitchen, the woeful lack of cleanliness in most kitchens (I say "most" advisedly from a bacterial standpoint), account for the many cases of ptomaine poisoning that we read of.

It is much to be desired that Farmers' Institutes should take up the matter of hot water and clean hands in reference to the whole question of clean and safe food. As was said in regard to milk, the old-time care of the farmer's wife has been replaced in too many cases by ignorant "help," who innocently allow many unsanitary practices which a little teaching would correct.

It is fortunate that the odor of putrefaction is so pronounced that a cultivated sense of smell may detect danger. Custom has sanctioned so "high" a flavor, however, that poultry especially is frequently set before one in an evident state of decomposition. Some of the

worst cases of ptomaine poisoning on record have been caused by eating soup made from such fowls. These toxic substances are not destroyed by heat and are soluble, so that while the meat itself may frequently be eaten with impunity, the broth causes illness.

The sale of poultry is becoming a matter of strict legislation. Authorities differ, as usual, regarding the comparative danger from the easy access of bacteria to drawn poultry, or from the decomposition of the undrawn entrails.

"Ordinarily poultry will remain sweet for a week or more in a temperature of 50° F., but if it is to be kept longer it must be stored in a dry place at a temperature no higher than 34° F. In such cold storage it will keep almost indefinitely."[1]

It is to be feared that advantage has sometimes been taken of this fact to keep poultry "almost indefinitely."

If drawn carelessly, bits of liver or lungs are left and easily decay, and parts become infected by unclean hands, and slow decomposition goes on to burst into flame, as it were, while the article is in transit to the consumer. The Southern practice of killing as needed has much to recommend it from this point of view.

There is a certain risk of rapid decomposition of cold storage meats in hot weather which may be avoided by the use of superficial preservatives. If the meat was properly washed this would do no great harm, but too many cooks do not clean the surface sufficiently.

Cured meats, salted, smoked, and dried, should, of course, be prepared from sound material. The fre-

[1] Farmers' Bulletin No. 180.

quency with which bad tongue and corned beef are found leads to the conclusion that local butchers are careless. There is a temptation to put into the brine for corned beef meat that is too far gone to sell otherwise.

Meats once decayed cannot be made fit for human food by any process. To find out that they are spoiled is the cook's province before they go into the pot.

Sausages readily lend themselves both to filling and preserving. In fact, a bright-colored meat is always to be suspected.

Some preservatives, notably sulphites, prevent the odor and appearance of decay but permit a softening and deterioration of the fiber; others applied to meat already in process of decay may retard the exterior changes sufficiently to prevent a decided odor and leave the interior in an unfit condition.

The great danger of these toxic products of meat decay may well make it a crime to place on the market cuts with a possible taint.

The same general remarks apply to game and fish. There must be freshness and care in handling and cleaning before cooking, and an examination for spots already in process of decay.

If salted and cured fish are always soaked before preparing for the table, any borax or other preservative that may have been used will be washed off.

A word may be welcome on the much discussed subject of oysters and clams.

It seems incredible that any one would even consider fattening oysters under the mouths of sewers or digging

clams on a bank washed daily by the diluted sewage of a city; yet such is the practice. It is only another case of indifference on the part of the public to what is going on under its eyes. The only safe oyster or clam is one *known* by the purchaser to have been raised and prepared for market in water free from sewage. If one fears preservatives in barreled oysters, they may be washed and the liquid thrown away.

The best remedy for the condition of the meat market, as well as of the other markets, is to include in all public school education lessons in marketing and the appearance of fresh, untainted, untreated goods, to inculcate an independence which means a self-protection.

The constant cry for legal protection is a confession of weakness, of indolence, and of lack of fiber to win a way for one's self, which argues ill for the future of the republic. Food is an important element in effective life which should be studied, and to whose safe purchase and wholesome preparation time should be given unstintingly.

Clean markets mean a higher price for products, but the public will support the endeavor just as soon as it is convinced of the necessity and increased value of the materials. Glass cases are now commonly used in the department stores, and thus an effort is made to eliminate some sources of danger present in the markets.

# CHAPTER IX

## PERISHABLE FOODS — VEGETABLES AND FRUITS

VEGETABLES are usually understood to include certain roots and tubers, as the potato, sweet potato, turnip, onion, carrot, parsnip, and beet, with some fruits, as the tomato, squash, and cucumber. These are used in the fresh condition, and are not subject to adulteration. They are largely composed of water, 75 to 95 per cent. The small nutritive value which they possess is due to the starch and sugar, and not to the nitrogenous material, which is present in small quantity only. The percentage of "ash" is higher than in cereals, and contains more potassium salts.

When much salted meat is eaten, fruit and vegetables are very essential correctives of diet on account of the acid and possibly on account of the potassium salts, which are supposed to replace the excess of sodium salts taken with the meat.

The common vegetables, onions, carrots, parsnips, etc, need not be discussed save to emphasize the necessity of cleaning them, and the value of the special substance contained in the diet. They form a large part of the ready diets of the various countries.

Greens, spinach, asparagus, lettuce, celery, and the like, are to be watched for contamination from soil fertilizers and unclean handling. Peas and beans, if

purchased shelled, should be washed for the same reasons.

An illustration of possible dangers in the use of uncooked vegetables is found in the prevalence of hook worm disease in Panama, where, owing to the fertilizing with night soil of the ground in which lettuce is grown, the lettuce, after being washed in cold water, must be plunged into hot water and then cooled on ice. In Manila special cleaning of vegetables is needed on account of the dysentery amœba. Many mysterious cases of disease doubtless arise from eating imperfectly cleaned green foods.

All vegetables which grow in or in contact with the ground, especially today, when spraying with poison is so widely resorted to, should be thoroughly cleaned before cooking. For the same reason currants, gooseberries, and grapes should be washed before eating raw. In short, here, as everywhere, cleanliness is the watchword.

There is little danger in the use of vegetables and fruits as food if they are fresh, not wilted, and are fully grown or ripened. They add a certain bulk to the meal which seems to favor digestion.

The seeds of the *Leguminosæ*, peas, beans, and lentils, may be called meat substitutes, since they contain about 25 per cent of nitrogenous substance, 12 per cent of water, and 50 per cent of starch. As dried seeds they should stand next in importance to the cereals; but since beans and peas especially are eaten green, as vegetables, even more than in the dried state, they cannot be omitted in this list.

This form of food is not sufficiently appreciated, especially by working people. It should be eaten with starch or fat foods. Hence the New England dish of baked beans with pork was a perfectly suitable and well-proportioned food for people whose life was spent largely in the open air in arduous pioneer work. The nutritious seeds are less easily digested than the cereals. The "ash" contains more lime and less phosphates.

The vegetarian and some subtropical peoples obtain their proteid food largely from these foods. The frijoles of the Mexican, the soy bean of the Chinese and Japanese, the lentil of Egypt, and the various European varieties furnish a large portion of mankind with an inexpensive substitute for meat.

The soy, or soja, bean (*Glycine hispida* or *Soja hispida*) has several varieties, all native of the East. It is being introduced quite extensively into the United States. It contains a high per cent of proteid, and the carbohydrate seems to be different from the other beans. It furnishes the best source of diabetic food, since starch is entirely absent.

### FRUITS

Fruits, so called — apple, pear, grape, peach, orange, etc. — contain sugar, instead of the starch of the vegetable, and also an acid which gives a pleasant relish and is a stimulant to the appetite. The general composition of fruits may be stated at 85 per cent water, 8 per cent sugar, and 1 per cent acid.

The ripening of fruits is a chemical change of the more solid, gummy, or starchy substances to the soluble

sugars dissolved in the water juices, for fruits are even higher in water content than milk. The delicate skin of many fruits is readily punctured and access is made easy for micro-organisms always lying in wait, and as soon as the skin becomes cracked decay sets in.

The exposure on the street of fruits, especially those with rough skins or crushable berries, as raspberries, blackberries, etc. — a collecting ground for dust — renders them unfit for food without more thorough washing than they often receive or it is possible to give them. Children who buy and eat them from the stand run great risks, perhaps not from deadly poisons, but of digestive disturbances which may lead to fatal illness. The great increase of fruit on the market is not an unmixed blessing, since a greater amount of damaged fruit finds its way to the tenement house children and is as responsible for illness among those from five to ten years of age as bad milk is for sickness among infants. More careful inspection of fruit is needed.

These facts should lead to a more careful scrutinizing of the fresh fruits, before they are put upon the table, for the micro-organisms which are present upon them.

Apples are the American fruit *par excellence.* In 1905, 2,000,000,000 bushels of this fruit were marketed. The apple is a smooth-skinned, solid fruit, not easily marred, and therefore readily transported without excessive loss from decay. It may be cleaned so easily that there is no excuse if it causes trouble. It has an agreeable flavor and serves as a condiment to other foods. The old-fashioned process of drying it in thick sections permitted the browning by an enzyme oxadase which

somewhat injured the flavor. Moreover, as we now realize, the exposure to flies is an added risk.

The modern evaporated apples, sliced and dried quickly, serve, when properly cooked, in almost all ways as well as the fresh fruit. Sometimes bleaching by sulphite is resorted to. If the first short soaking water is thrown away after the fruit is washed, nearly all danger from the sulphite is averted.

Nearly the same statements apply to peaches and apricots and plums. They are not so easily transported, being of softer flesh. Their outer skin is fuzzy, or downy, and hence holds more micro-organisms, and it cracks more easily; on the other hand, they dry rather more readily. The dried plum is known to us as the prune.

The peach is short-lived, and at best remains in good condition but a comparatively short time, whereas the apple may be kept for months, or even for a couple of years, in such condition that the cells are apparently able to perform their natural functions, though to a somewhat diminished extent.

Grapes. About 1,500,000,000 pounds of grapes were raised in America in 1905, and of these probably two-thirds went to the consumer in four and eight-pound baskets.

The banana tree (*Musa sapientum L.*), although extensively cultivated in tropical America, is a native of the Old World. It is said to produce more food to the acre than any other plant. Whether eaten as a vegetable, cooked or raw as a fruit, it is a valuable addition to the table. Banana flour is beginning to be found on the market and should come into favor.

The pineapple (*Ananassa sativa Schult.*), a tropical American fruit, is somewhat abundant in our markets. The pulp appears to contain an enzyme which is a powerful digester of proteids, and if separated from the irritating outer layer may come into use as an aid to weak digestion as well as a pleasant fruit.

The date palm (*Phœnix dactylifera L.*), one of the most ancient trees, has a fruit which furnishes the desert Arabs and other wanderers with their chief food.

A more or less well-founded suspicion that the dried packages have not been handled in a cleanly fashion is doubtless the occasion of the prejudice against this most nutritious and tasty fruit.

That we shall not always be dependent on this supply has been provided by the government.

"The transfer from the great deserts of the whole world to those of the new of the unique date industry is an accomplishment of which the government may well be proud. . . . Though the attention of the public was first attracted to the possibilities of growing the foreign date palm in this country through chance seedlings that bore fruit and through an early introduction of the pomologist of this department, it was the exploration trip of Mr. Swingle to the Desert of Sahara in 1899 that first proved the feasibility of starting commercial date plantations in Arizona and California. From the time when the first large shipment of palm suckers reached the Southwest until the present, the Office of Plant Introduction has had an explorer in some one or other of the date regions of the Old World, gathering plants for the government plan-

tations. Today the list of introduced varieties numbers over 170, and more than 3,000 palms, large and small, have been imported and planted out. The best sorts from Egyptian oases, selected kinds from the valley of the Tigris, the famous dates of Southern Tunis, and even the varieties from uncivilized Beluchistan have been gathered into what may proudly be called the best collection of date varieties in the world. This search through the deserts of the world has revealed the fact that the dates of our markets are only one or two kinds of the host of sorts known to the true date eaters, the Arabs, and that those we prize as delicacies are by no means looked upon by the desert dwellers as their best. The search has brought to light, as well, the hard, dry date, which Americans do not know at all, and which they will learn to appreciate as a food, just as the Arab has. Already Algerian and Egyptian imported palms have borne and ripened fruit."[1]

### DRIED FRUITS

Dried or evaporated apple, peach, and apricot may be had in various qualities for a low price per pound. If the product on the market was originally good, the "evaporation" does not appreciably injure it.

It is only when inferior and green fruit has been dried that one fails to receive the worth of one's money. The much derided prune is being so extensively cultivated in California that it may come into the favor it deserves. Perhaps if it were known by its true name of plum it would gain in favor.

[1] Fairchild: National Geographic Magazine, June, 1906.

Raisins, figs, etc, have a nutritive value nearly equal to that of bread, containing 40 to 50 per cent of sugar. Raisins have proved an excellent food for Arctic expeditions, sustaining the animal heat under extreme conditions.

# CHAPTER X

## CANNED FOODS AND JELLIES

THE habit of apartment house and hotel life makes it impossible to do much home preserving, and the difficulty of doing on the farm all that is needed in the few short weeks of fruiting time makes it inevitable that the factory must turn out most of the product. It is true that much more may be done on the farm and in the country than is now customary in the way of saving fruits and vegetables when they are in their prime. The United States Department of Agriculture is preparing bulletins on preserving vegetables as companions to Miss Parloa's on "Home Canning of Fruits."

It is possible to supply the table of a dweller in a large city with fresh hothouse grown string beans, peas, beets, tomatoes, etc, every day in the year, but to the country dweller and to the person of limited means there is the possibility of quite as good a flavor from canned goods at a much smaller price. Because the forced products never have the same fully developed flavor that the same products have in their proper season, many city people have forgotten, if they ever knew, the real flavor of fresh vegetables. The canned vegetables, when of the good quality that are put up in their prime, retain more of the true flavor than do those that are forced. They are more difficult to

prepare than fruits, partly because of the starchy nature, which favors fermentation.

Just a word here on the fundamental principles of preserving such perishable articles. It means killing all the low forms of vegetation, such as molds and bacteria on the surface of the fruit or vegetables, together with any that may get in during the handling necessary in preparation and any clinging to the vessels used in the process. Heat is the best sterilizer, and if it did not injure the flavor and appearance it would be a simple matter to "put up" any of these things. It is, however, a nice distinction to draw the line between the degree of heat needful to kill the undesirable plant life and that which harms the subject of the operation. Mr. E. F. Pernot, of Oregon, has made experiments on canning vegetables and fruits. He finds that the most successful method is the heating of *clean, fresh* vegetables in jars of sterilized water. The jars are sealed and heated to 165° F. for fifteen minutes. They are then allowed to stand for twenty-four to forty-eight hours, after which the operation is repeated. Still a third time the jars were heated and the process completed.[1]

Again, these objectionable plants, while easily killed, have "seeds," or "spores," which endure a greater heat, and so sprout in a few days. This necessitates a second heating and greater danger to flavor and appearance. To obviate this, various preservatives have been added. In our present ignorance as to the effect of such additions on health it is wisest to omit them and cook

[1] Oregon Experiment Station, Bulletin No. 87.

sufficiently to preserve the fruits and vegetables without them.

It goes without saying that, other things being equal, a tall, narrow jar or can will serve better than a short, wide one. The cans of French peas are a case in point; the narrow bottles of our grandmothers offer another.

Vegetables contain more proteids, as a rule, than do fruits; they also harbor more organisms, and are correspondingly difficult to keep. Compare sweet corn and pears, for instance. The small kernel is attached to the cob by a narrow hook, with plenty of room around the socket for the hiding of molds and fungi; these mingle with the corn as cut from the cob, and it is no wonder that the keeping of corn is more difficult than that of the large, smooth-coated pear.

Great use is made of canned goods, from the housewife's dozen jars to the tons put up in tins by large concerns. Most of these are wholesome and valuable additions to the bill of fare. When put up whole defects are visible, and it is chiefly from preservatives that there is danger. These are more probable in the handsome product in glass jars. Benzoic acid has been found, and in some brands both this and the sulphites. Sulphite preparations have been sold to the housewife to enable her to compete with the shop in appearance.

The universal use of tin cans has led health authorities to watch closely for excess of tin and lead from careless soldering, with the result that today only the best quality of tin and lap solder on the outside are found on standard goods. In the earlier days of can-

ning even condensed milk has contained enough lead to give rise to lead poisoning of children. It was not uncommon to pick out lumps of solder, several of them as large as peas or beans, from a can of tomatoes. With better knowledge, these poor quality cans are little used; still the housewife will do well to scrutinize a few cans of each new brand to see if the joints are lap joints, that means, showing no solder inside, and if the tin is without evidence of action by acids. The poor quality tin is an alloy much more readily acted on.

The danger from the solution of tin and lead is much greater when canned goods are depended upon for staple foods in camp in distant regions. It is undoubtedly true that time does increase the amount dissolved, so that dating would have a certain value.

The cry has gone over to the coloring matter introduced as coal tar color. This is added from purely æsthetic considerations, and it is wholly in the housewife's power to stop it by refusing to buy decorative fruits, jams, and jellies.

Meats which are to be used for canning are usually partly cooked first, and then put into cans and heated and sealed. If the meat is in good condition there is no occasion for adding any preservative or extraneous substances.

The housewife should see to it that each can is examined when opened, for both appearance and odor will reveal bad conditions nine times out of ten. Also explicit directions should be given to empty the metal can as soon as it is opened, and to put the can where it cannot hold water to breed mosquitoes.

When proper precautions are taken the danger from canned goods is no greater than from articles purchased in the open market.

From the extensive investigation being made in the state laboratories from one end of the country to the other this year (1906), it seems fair to conclude that many of the "minced" products sold under the name of meats have been "filled" with corn meal, which also allows more water to be held in the material than in meat only. Occasionally an excess of zeal for utilizing waste products has made these canned goods a dumping ground for scraps better sent to the fat extractor or the fertilizer house. In some cases preservatives have been added.

But the public should know that the temptation to extend a finely divided substance, which to the unaided eye is homogeneous, is too great to be resisted by unscrupulous manufacturers.

As in the case of meats, the products in which the original form of fruit or vegetable is not kept offer the widest field for both sophistication and adulteration, that is, catsups, sauces, jams, jellies, etc. It is said that, as in pickling of meats, these materials are often collected during other processes and kept in barrels or tanks until enough has accumulated for putting up. It is reasonable to suppose that this is sometimes done and that preservatives are added to such tanks.

"Sterilized by heat and sealed from contamination by germs, there is no class of food stuffs in so little need of preservatives. It should be taken as almost positive evidence of careless methods in packing if

preservatives are found present. These may have been used to prevent stock spoiling while awaiting the final process of canning, or to assist in preserving it from further deterioration, fermentation having set in. In many cases artificial coloring is resorted to in order to make the goods more attractive. This is especially the case with tomatoes, and indeed with them the matter is often overdone and they are colored beyond the natural degree."[1]

### JELLIES

In the case of jams, jellies, and preserves, the ignorance of the consumer who has never seen the processes of "putting up" fruit has permitted the manufacturer to palm off unsuitable articles. The buyer has no knowledge of and takes no pains to inform himself about the appearance of the pure article, and is easily persuaded that an inferior one is just as good. He pays the usual penalty of ignorance, in money, in health, and in self-reproach. It is possible to know all about the goods we buy, as was said earlier. The taxpayer supports laboratories for the purpose of protection, but all their efforts are multiplied because the buyer will not take the trouble to read the labels that the law has made plain.

The people have this matter in their hands. The use of preservatives has prevailed because, as in many other directions, appearance is valued before quality, color before flavor. Indeed the average palate seems to have no discrimination.

[1] Report of Professor Willard in the Bulletin of the Kansas State Board of Health, June, 1906.

Jellies are a sort of dried fruit juice. Many fruits contain a substance called *pectin* or *pectose*, which forms, when heated with sugar, a gelatinous mass that will keep for a long time if put in a cool and dry place.

Substitute jellies and jams are abundant on all markets, for they can be sold at a profit at a price which brings them within the means of all, and in most cases they furnish a wholesome variety and add a needed flavor to a monotonous diet.

According to law these mixtures are to be labeled for what they are, so that no one need be deceived. Perhaps right here the author's suggestion of a high school museum, showing the characteristics of the local market, may be emphasized. A case in the hallway or some other convenient place where all the pupils may spend a few idle moments any day in reading the labels and familiarizing themselves with the appearance of pure and adulterated goods will do more than any one thing toward the enforcement of legal restrictions. As has been said repeatedly, it is ignorance which has permitted such a state of things as has been revealed in certain quarters. The Kansas Bulletin just quoted describes a brand of "compounded" preserves:

"On the label, which is covered as much as possible by the word Columbia, appears this statement: 'Twenty-five per cent selected fruit, thirty-one per cent apple juice, thirty-seven per cent corn syrup, six per cent granulated sugar. This sample is colored with coal tar dye, preserved with sodium sulphite, and sweetened with glucose.'"

Find out from your state bulletins which are the

best brands on your markets, and do not try every new thing that you see advertised.

The extension of these various processes for keeping perishable food for months and for transporting it hundreds and even thousands of miles has been so great a boon to explorers, to prospectors in the mountains, to dwellers in the desert, to campers and vacationists, to the housewife with unexpected company, that the good far outweighs the evil of a few spoiled cans, even of occasional preservatives.

# CHAPTER XI

## CONDIMENTS

### MUSTARD

THE mustard of commerce is the seed of the plant *Sinapis*, of different species, ground into flour. It belongs to one of the most useful families of our temperate zone, the Mustard family (*Cruciferæ*). It is a hardy plant, and grows very readily in our climate. The famous Durham mustard was originally made from the wild charlock (*Sinapis arvensis*), which grew abundantly around Durham and has a pleasant, mildly pungent flavor. The name is still retained as a trade-mark. The charlock grows as a weed in our wheat fields and furnishes a product known in the trade as Dakota mustard. Along the coast of Ireland the fields, as seen from the passing steamer, look yellow with the blossoms of the wild charlock, or Charlie, as it is familiarly called. Black and white mustard are the two kinds usually found in the market, the seeds of *Sinapis nigra* and *Sinapis alba*. Since the whole seeds are to be had, the best way to study the condiment is to purchase some seeds and grind them. Several points of difference between this undoubtedly pure article and that which is bought ground will be noticed.

In the first place the ground seeds have much oil. This is not the pungent, volatile oil (*Allyl sulphocya-*

*nide*) which gives the flavor, but a bland, fixed oil which is always expressed from the seeds before they are manufactured into mustard. Next the color of the pure mustard will attract attention. There is no mustard of a bright yellow color, the brightest possible color being a dull yellow. The bright yellow of the shops is either largely rape seed or artificially colored to suit a popular taste. Another noticeable difference is in the pungent smell and taste of the home-ground article. If such mustard is used for a time that of the shops seems very insipid.

Mustard is one of the most universal and wholesome condiments, but its use in medicine is even more important. It is of the utmost consequence to have a genuine article when it is to be used as an active remedy in sudden illness. The balance of life and death may depend upon the quality of the mustard used for the emetic, the plaster, or the bath. Every housekeeper should see that her medicine chest is supplied with pure mustard, whatever may be the quality of that in her spice box.

The adulterations are many. Probably two-thirds of the mustard sold is anything but pure ground seeds. The principal ingredients are starch from wheat, rice, or corn flour, turmeric to color the too white starch, rape seed, old turnip and radish seed unfit for planting, linseed, etc.

Of thirty samples examined in the laboratory of the writer, twenty-one contained more or less starch. Hardly any seeds of *Cruciferæ* contain starch; hence its presence is a proof of adulteration. The blue or

dark purple color which iodine causes in starch grains and the thickening in boiling water are the simplest tests. In eleven samples turmeric was added. This is readily detected by the microscope, as are also the other seeds. The per cent of oil may be used to determine the relative strengths of a number of samples, since it is upon the volatile, pungent oil that the peculiar properties of mustard depend.

### PEPPER

Peppercorns are the berries of the plant *Piper nigrum*, which grows only in tropical climates. Hassall says that Malabar, Penang, and Sumatra are the three kinds most prized. Black and white pepper are from the same plant, the only difference being that black pepper is the whole berry dried while green, while the white, after ripening, has been deprived of the husk or outer layer of the berry, which is black. White pepper is milder than the black, for the husks are quite pungent The best is that from the whole berry. A good way to secure pure pepper is to use a little mill on the table, and to grind the whole berries as wanted. The active properties of pepper depend upon three substances: about 16 per cent of acrid resin and piperine, and 1 to 2 per cent of volatile oil.

The adulteration of pepper is extensive. Indeed it is the exception rather than the rule to find a pure article in the market. Wheat flour, ground rice, Indian meal, husks of the London-made white pepper, husks of mustard, nutshells, charcoal, peas, poppy seeds, exhausted pepper and the mysterious "P. D." pepper

dust, said to be the sweepings of the warehouses, can be imported for as many cents a pound as the prepared article can be sold for an ounce; so that there is great temptation to use these harmless but not tempting mixtures. Time and trouble are saved by the purchase of ready ground condiments, but the price paid is too great in proportion.

Of sixteen samples examined three were fairly good; nine were made up of pepper and mustard husks, flour, and Indian meal. Most of the adulterations can be detected by the microscope, after a careful study of the structure of the various seeds and husks; but experience has taught the writer that considerable practice is required to become expert at the detection of the kind of foreign matters used.

### CAYENNE PEPPER AND PAPRIKA

Red or Cayenne pepper is made from the ground pods of various species of Capsicum, a plant of the Nightshade family. The cayenne of commerce is derived from tropical species, but the pods of the red peppers which are commonly cultivated for pickles, when ground, make a very good cayenne. The peculiar pungent taste is due to the presence of about 4 per cent of an acrid resin. The earlier English writers state that cayenne is more liable to adulteration than black pepper, and alarming stories are told of the presence of red lead, mercury, etc. But the results of examinations made in this country do not show any poisonous addition, and the addition of flour, etc, is rather less than in black pepper.

The Hungarian red pepper, or paprika, is a mild variety of *Capsicum annuum* which is coming into favor as being less biting.

Sawdust from red sandalwood and coal tar colorings are sometimes found in these peppers.

The following figures are taken from official reports from Massachusetts:

In 1901 of thirty-nine examined nine were adulterated with plaster, wheat, corn meal, coal tar dye, dirt, ginger, pepper shells, olive stones, sawdust.

In 1902 of sixty-six examined six were adulterated with plaster, wheat, corn meal, coal tar dye, dirt, ginger, pepper shells, olive stones, sawdust.

In 1903 of sixty-one examined one was adulterated with plaster, wheat, corn meal, coal tar dye, dirt, ginger, pepper shells, olive stones, sawdust.

In 1904 of seventeen examined six were adulterated with plaster, wheat, corn meal, coal tar dye, dirt, ginger, pepper shells, olive stones, sawdust.

Samples examined in Michigan show:

In 1901 of twenty-seven examined nineteen were adulterated as above.

In 1904 of 129 examined seventy-four were adulterated as above.

## SPICES

Those spices, like nutmeg, cloves, stick cinnamon, mace, and allspice, which are bought by weight and in the form in which they are gathered are not exactly capable of adulteration. But there is a certain deception to be guarded against. An inferior or cheaper

quality of the same or of a similar kind of spice may be mixed with or substituted for better or more costly sorts without any corresponding diminution in price.

For instance, wild nutmegs are mixed with cultivated ones, bearing about the same relation to the best qualities that a cider apple does to a fine Baldwin. It is the same with mace and cloves, while cassia is so largely substituted for cinnamon that it is almost impossible to find stick cinnamon that is not mixed with cassia. To learn to know the genuine species with certainty is our only safeguard. Then if we choose to buy cassia we shall do it with our eyes open and without paying the price of the delicate and costly cinnamon.

### NUTMEGS

There are three species of *Myristica* which furnish nutmegs. The best are the kernels of the *Myristica fragrans*, and are called queen nutmegs. The tree is a native of the East India islands, but is also cultivated in India and Central America. The best nutmegs are those from Penang, which are about an inch in length, shaped like a damson plum. The kernels are usually pickled in lime water, to ward off the attacks of insects to which they are particularly liable. The weight of good nutmegs should be, on an average, one hundred to the pound, or nearly seven to the ounce, grocers' weight. Very fine ones weigh eighty and one hundred to the pound, or five or six to the ounce. If pricked with a pin the oil exudes visibly, and the pin also penetrates readily. Wild nutmegs are small and pointed. They are inferior in the amount of oil and in the general fragrance.

### MACE

Mace is the aril of the nutmeg, and its quality depends very greatly upon the kind of kernel on which it grows, the aril of the queen nutmeg being the best.

### CINNAMON

The best cinnamon comes from Ceylon. It is the bark of a tree of the Laurel family, which gives us, even in this temperate climate, such plants as our sassafras and our spicebush. The trees are topped like osier willows, and the cinnamon used is the bark from the young shoots which form the bush at the top of the tree, and which are cut twice a year. A tract not much more than a quarter of a mile square forms the great cinnamon orchard of Ceylon. No other country produces so fine a quality, or so great a quantity, as the fertile and siliceous tracts of Ceylon and the neighboring islands.

The most noticeable character of true cinnamon is its splintery, fibrous quality. It tears rather than breaks, and is in small, thin rolls. The taste is sweet and spicy, and it retains its flavor long in the mouth.

### CASSIA

Cassia is used to mix with cinnamon, being cheap and abundant. It is coarser and in thicker rolls. It breaks readily but does not tear, and if chewed is granular and rather mucilaginous. It lacks the delicate, sweet taste and smell of cinnamon, having a peculiar woody, strong flavor of its own.

China or Canton cassia, the *Cassia lignea* of the

pharmacists, is the commonest and cheapest, costing about half as much as that of Batavia and one-fifth that of Saigon. It is the bark of a small evergreen found in Southeastern China.

The tree from which Saigon cassia, the most pungent and expensive of all the cassia or cinnamon barks, is taken grows in Cochin China. It is not unusual to find 4 or even 5 per cent of oil in good samples.

### CLOVES

Cloves are the unexpanded flower buds of the *Caryophyllus aromaticus*, a tree of the Myrtle family, which is a native of the Moluccas, but which is cultivated in the East and West Indies, Guiana, Brazil, and the Philippines. Like all the spices under consideration, the active principle is due to one or more oils, which may be and are extracted and sold as oil of clove, oil of cassia, etc. Whole cloves containing 15 to 25 per cent of essential oil can hardly be said to be adulterated, although the stalks are sometimes in excess of the buds. Advantage is taken of the property of imbibing a large portion of moisture to increase the weight, and exhausted cloves are sold after distillation of the oil.

### PIMENTO, OR ALLSPICE

Pimento is the berry of the *Eugenia pimento*, a tree of the Myrtle family, a native of the Caribbee Islands, and also cultivated in the East Indies. The berries have a fragrant odor, supposed to resemble a mixture of cloves, cinnamon, and nutmegs; hence the name of allspice.

### GINGER

The ginger plant (*Zingiber officinale*) belongs to the order from which turmeric and East India arrowroot are obtained. It is a native of India and China, and is cultivated in tropical America and Africa. The ginger of commerce is derived from the fleshy, creeping rootstalks, which are dug up when about a year old, and, if scraped and dried, give white or Jamaica ginger; if left coated, or unscraped, black or East India ginger. Calcutta exports the principal part of the ginger used. Ginger contains, besides the volatile oil, an aromatic resin.

African and Calcutta ground ginger is brown; that from Jamaica, Japan, etc, being from scraped roots, is white or light buff.

After being treated with alcohol in the manufacture of ginger extract, or with water for ginger ale, the residue is used to adulterate fresh materials. Rice, bran, linseed meal, cereals, and turmeric are also found as adulterants.

Massachusetts reports give the following figures with regard to ginger:

| | Examined. | Adulterated. | Adulterants. |
|---|---|---|---|
| 1901 | 253 | 20 | Wheat, rice, dirt, turmeric, buckwheat |
| 1902 | 246 | 17 | |
| 1903 | 224 | 9 | |

### CURRY

Curry is not so extensively used in America as it deserves, yet it is found so often as to justify a word.

It is composed of a mixture of spices and highly colored with turmeric. It is liable to variations of strength, as are the spices of which it is composed.

### ADULTERATION OF SPICES

In ground spices, as a rule, we find much reason for dissatisfaction. Their only merit now is convenience, not quality. Nutmegs, mace, and cloves are so oily that to grind them easily some absorbent like sawdust or starch is added, and this becomes a part of the ground spice as the first step, whatever may be added later. There is, however, but little demand for ground nutmeg, American housekeepers having the good sense to prefer the whole nuts.

Twelve specimens of cinnamon were examined. Only three of these contained any cinnamon at all. Even these were mixed with cassia and sawdust. The other nine were chiefly cassia and sawdust, mahogany sawdust being distinctly identified in some of them. Two contained a very little cassia and a great deal of sawdust, and the third was nothing but sawdust, there being no trace of any spice in it.

All these spices may be examined under the microscope[1] for adulterations; but, as has been said before, only experience will give the training of the eye which will render an opinion worth anything. Each kind of spice here mentioned has its own peculiarities, and after these are thoroughly studied the additions may be at once determined. The adulterations are much

[1] See Microscopy of Vegetable Foods. A. L. Winton and J. Moeller.

the same in all this class — starch in some form, turmeric for color, mustard husks for pungency.

The following table is taken from the Massachusetts report for 1904:

| | Examined. | Genuine. | Adulterated. | Per cent. adulterated. |
|---|---|---|---|---|
| Allspice | 159 | 154 | 5 | 31.4 |
| Cassia | 192 | 191 | 1 | 0.5 |
| Cayenne | 50 | 50 | 0 | 0.0 |
| Ginger | 216 | 212 | 4 | 1.9 |
| Mace | 31 | 19 | 12 | 38.8 |
| Mustard | 226 | 195 | 31 | 11.6 |
| Nutmeg | 16 | 15 | 1 | 6.3 |
| Pepper | 346 | 333 | 13 | 3.8 |
| Vinegar | 54 | 34 | 20 | 37.1 |

### VINEGAR

Vinegar (*vin aigre*), as its name implies, was originally made from sour wine, that is, from wine in which the alcoholic fermentation had given place to that which produces acetic acid. The whole of the alcohol may be changed into acetic acid by means of the vinegar ferment (*Mycoderma aceti*), commonly called "mother of vinegar." A very little of this in the presence of air is sufficient to convert a large quantity of alcohol.

In the United States and Canada vinegar is derived chiefly from cider. The best of it is made by a long process of fermentation in casks. The casks are half filled and left, with bungholes open to allow the free circulation of air, in a warm cellar or exposed to the air. This process requires two or three years unless the change is hastened by the addition of old vinegar.

A lack of patience impels most manufacturers to resort to a quicker method, known as the "generator" process, by which the cider is allowed to percolate through a filter of beech wood shavings or birch twigs saturated with old vinegar. This process requires only two or three days.

In France and Germany pure vinegar is understood to be made from wine, while in England vinegar means malt vinegar.

Proof vinegar contains about 5 per cent of acetic acid, but that sold in the shops often contains only 3 per cent, or even less.

The methods of adulteration of vinegar are (1) by dilution, (2) by mixing with cheaper sorts, (3) by the substitution of cheaper grades, with the possible addition of mineral acids, coloring matter, or spices for flavoring. Entirely artificial substitutes for vinegar are made up of distilled or spirit vinegar, that is, vinegar made from distilled whisky, brandy, or grain alcohol, colored with caramel and thickened with a jelly made from exhausted apple pomace (the refuse left after all the juice has been expressed from the apple stock by the cider mill).

Wood vinegar from pyroligneous acid, derived from wood by distillation, is sometimes flavored with acetic acid.

Simple tests of vinegar may be made by evaporating in a shallow dish. The residue from cider vinegar has the odor of baked apples and a slightly acid flavor; the odor and taste of the residue from wine vinegar are decidedly vinous.

## PICKLES

Cucumbers and various other vegetables, such as onions, cauliflower, string beans, beets, and peppers, are preserved in vinegar as pickles. For the finest qualities the pure cider, wine, or malt vinegar is used. These are usually preserved without cooking. The cucumbers and other hard vegetables, having been first soaked in brine, the soft vegetables, like beans, having been soaked in water, are then treated with boiling vinegar.

In the case of pickles, a depraved taste has led to the demand for bright green pickles, and this taste has sometimes been gratified by adding copper sulphate or by boiling the pickles in copper kettles with vinegar and a little alum. The acetic acid of the vinegar acts upon the copper, forming a little acetate of copper, one of the most poisonous of all the salts of copper; and this, being absorbed by the pickles, colors them green. Cheap pickles are put up in so-called "white wine," or spirit vinegar. For the presence of copper, immerse a strip of clean, bright iron in the liquid, and if copper is present the iron will become coated with a thin film of metallic copper in a few minutes.

Olives are usually pickled before they are wholly ripe. They are soaked first in a solution of potash and lime, then in cold water, and finally preserved in a brine which may or may not be flavored with fennel, laurel leaves, coriander, or vinegar.

A queen olive is simply a large-sized fruit and not a special variety. The ripe olive is growing in favor and is said to be more digestible than the green.

Capers are the flower buds of *Capparis spinosa* pickled in vinegar.

### SALT

Salt is of universal use, and it has been known from the earliest times. It is found in a solid, rocklike form in many countries. Salt springs are not uncommon, and on the coast the evaporation of sea water gives sea salt. Rock salt is mined in Austria and at Northwick, near Liverpool, in England. A mine is now worked in Louisiana. Much salt is made in New York, Michigan, Ohio, Virginia, and West Virginia by evaporating the water of salt springs. Salt is nearly pure sodium chloride, but it almost always contains small quantities of chloride of magnesium, which causes the salt to become moist in damp air, and which gives it the bitter taste often noticed.

A little cornstarch may be mixed with salt to keep it dry. If this is done by the manufacturer it should be so stated on the label.

There is a difference of opinion as to the healthfulness of salt when taken with food. Habit, rather than common sense, seems to govern the amount used.

### FLAVORING EXTRACTS

These have had, periodically, highly sensational stories told about them. In the two or three dozen samples examined in the laboratory no harmful ingredient was found. There was a great deal of difference in the strength of the different brands.

Most of the "pure fruit flavors" on the market should be sold for what they are — artificial essences.

Since it is, in many cases, impossible to keep the true fruit flavor in extracts from the fruits themselves, certain compounds are mixed to imitate the fruits as nearly as may be.

Raspberry, peach, and orange essences are most complex in composition when artificially prepared, raspberry being made up of fourteen ethers and acids in glycerin added to alcohol.

### LEMON

In lemon extract a large proportion of alcohol is required to hold in solution the valuable oil of lemon, which is insoluble in water. The temptation, therefore, is to use weak alcohol, which does not dissolve the oil, or to substitute artificial acids and flavors. Methyl alcohol has been known to be used.

The flavor of the cheap extracts is enhanced by citral, oil of citronella, and of lemon grass in minute quantities. The extracts of standard quality are colored with lemon peel, but as this coloring does not last coal tar dyes and turmeric are used extensively.

TABLE OF LEMON EXTRACTS EXAMINED IN MASSACHUSETTS

| | No. examined. | Adulterated. | Adulterants. |
|---|---|---|---|
| 1901 | 167 (representing 100 brands) | 139 | Foreign color and insufficient amount of lemon oil |
| 1902 | 16 | 13 | |
| 1903 | 27 | 19 | |
| 1904 | 32 | 19 | |

In 1903–04, of fifty-three examined by the New Hampshire State Board thirty-four were adulterated.

A convenient test by which the consumer may get some idea of the quality of a sample of an extract of lemon is the addition of about three times as much water. If the liquid becomes turbid on account of the separation of the oil of lemon, the sample contains a fair amount of this oil; but if it does not become cloudy on the addition of water, the extract is of a very poor grade.

### VANILLA

The source of vanilla extract is the vanilla bean, the fruit of the *Vanilla planifolia*, which is an epiphyte belonging to the *Orchidaceæ*. It is a native of Mexico, but is cultivated in tropical regions.

The flavoring principle, vanillin, is found in fine crystals on the surface of the bean. It occurs in from 1 to 2.75 per cent, according to the variety of the bean. Curiously enough, it is least in the most valued grades.

The following analysis of Tiemann and Harmann shows:

| | Per cent vanillin |
|---|---|
| Mexican beans | 1.69 |
| Bourbon beans | 2.48 |
| Java beans | 2.75 |

Vanilla is abundantly adulterated by artificial or synthetic vanillin and coumarin and with tonka bean extract. The latter is the seed of *Coumarouna odorata* and some other varieties. The flavoring principle is coumarin, the same as found in sweet grass, vernal grass, and in sweet clover.

Prune juice is also used to increase the bulk and give flavor to vanilla.

TABLE OF VANILLA EXTRACTS EXAMINED IN MASSACHUSETTS

| | Examined. | Adulterated. | Adulterants. |
|---|---|---|---|
| 1901 | 73 | 54 | Coumarin and vanillin |
| 1902 | 18 | 15 | |
| 1903 | 25 | 12 | |

ALMOND

Almond oil, according to the United States Pharmacopœia, has the following composition:

| | |
|---|---|
| Oil of bitter almonds . . . | 10 c.c. |
| Alcohol . . . . . | 800 c.c. |
| Distilled water sufficient to make | 1,000 c.c. |

The oil of almonds is obtained by the distillation of crushed bitter almonds or apricot seeds. Most of the commercial oil is from apricot and peach seeds, which give practically the same product.

Since prussic acid, which exists in the unpurified oil of bitter almonds, is known to be highly poisonous, its presence in almond extract should be considered a harmful adulteration.

Nitrobenzol, or oil of mirbane, is a heavy yellow liquid that is used as a substitute for the almond extract.

# CHAPTER XII

## OTHER MATERIALS USED IN COOKING

SINCE light, sweet bread is one of the most important articles of diet, and since in the United States such bread is largely made in homes, and not in bakeries, as is the case in Europe, the substances which produce this digestible food deserve consideration.

### YEAST

Yeast is a cryptogamous plant, a simple cell which grows by multiplication or budding in a slightly sweetened liquid, converting the sugar into carbonic acid gas and alcohol, at the same time that it acts upon starch, converting it into dextrin and then into starch sugar. The process is technically called alcoholic *fermentation*, and yeast a *ferment*. Different kinds of fermentation are distinguished by the name of the principal product to which they give rise, as alcoholic or yeast fermentation, acetic or vinegar fermentation, lactic, butyric, etc.

It is because of the evolution of carbonic acid gas, which is held in the sponge in little bubbles by the tenacity of the gluten of the wheat, that yeast is used in the preparation of bread. Wild yeast germs are floating in the air, and the leaven of olden times owed its efficiency to the cells which fell into the open vessel. The objection to this spontaneous fermentation is that

not only the cells of alcoholic fermentation fall in, but those that produce the other kinds, notably the lactic, so that bread-making by leaven is a somewhat haphazard process; the result may be fairly good, and it may be very bad. The black sour bread of Germany and other European countries is made in this manner. The addition of hops retards decay of the yeast. Modern yeast is brewers' or beer yeast, even homemade preparations being mostly started by it; because both for beer and bread the alcoholic fermentation is desirable, and brewers, by careful study and experiment, have learned so to control the process as to obtain a yeast consisting of only one kind of organisms, *Saccharomyces cerevisiæ.*

When yeast is added to batter it is like the scattering of a multitude of little living cells or seeds, ready to grow with extraordinary rapidity in a medium suited to their nutrition. These cells in well-mixed batter are present at every point; and as each cell in decomposing sugar gives off tiny bubbles of carbonic acid gas these bubbles are in every part of the dough, rendering it porous or "light." Although wheat flour contains only about one per cent of sugar, when fermentation is once started the starch is rapidly converted into sugar, and the sugar so formed into carbonic acid gas and alcohol; thus the fermentation of bread goes on at the expense of the starch of the flour. Cooked starch is acted on more readily than raw, and therefore the addition of some boiled potatoes to the sponge causes a more rapid rising.

There are two divisions of beer yeast, high (*haute*)

and low (*basse*). According to Pasteur the *high* buds more rapidly, floats, and is produced by fermentation at from 50° to 75° F. The *low* sinks, the cells are more separate, it buds only for a short time, is produced at a lower temperature (forty to fifty degrees), and is of late much used for beer. The best yeast for bread is that which floats. It is now prepared for the purpose, and when ready for use is skimmed off, drained, pressed in sacks, cut up into squares, covered with tin foil, and sold as compressed yeast. In this condition it is next best to the fresh brewers' yeast, with the advantage of small bulk and ease of transportation. If kept cool and dry it will be good for days; and if dried, not in the sun or in the oven, but in a current of warm air, it will keep indefinitely. Packages of dry yeast are composed for the most part of yeast mixed with corn or rye meal and then dried.

Yeast germs are killed by a temperature of boiling water, and freezing arrests their growth. The best temperature for fermentation of beer yeast is from 60° to 70° F.

Since the sole object of bread fermentation is the production of a porous loaf, Miss Corson's recommendation of the quick process of raising bread in two hours by the use of two squares of yeast seems to have a reasonable basis; and if the bread is, as it should be, well baked, so that the inside of the loaf has reached a temperature of boiling water, there will remain no yeasty flavor. Many loaves do not become heated to this point even when burned on the outside, consequently the yeast germs are not killed. Such slack-baked bread is not wholesome.

Yeast is not often adulterated, but its quality may vary, owing to carelessness in preparation, especially if it is homemade. There is no doubt that the compressed or Vienna yeast is the best article now at hand for producing the so-called raised bread. The color of good yeast is yellow or grayish yellow; the browner its tint the more dead germs there are. It should be only a mass of cells with no fiber or tissue. Occasionally a blue line is seen; this is due to the presence of *Mucors*, or molds. Such yeast makes bread which will become moldy in a very short time.

### SODA, BAKING POWDERS, ETC.

The problem of making porous bread without the long process of fermentation, and the consequent loss in material which is converted into carbonic acid and alcohol, has often occupied the thought of chemists of reputation. The results have been:

First, aerated bread, made by forcing into the dough, just before baking, carbonic acid gas prepared by chemical means in another vessel.

Second, the so-called soda bread of this country, in which the carbonic acid gas is liberated from bicarbonate of soda by the use of an acid, as muriatic, tartaric, lactic (sour milk), and the acid tartrate of potassium (cream of tartar), acid phosphate of calcium, or acid lactate of calcium.

Third, baking powder bread, which is almost universally used in the United States in place of soda bread. The great advantage to the community is, that while baking powders are composed of the same

materials as those mentioned above, they are carefully mixed, so that neither acid nor alkali shall be in excess.

### SODA

Soda (bicarbonate, supercarbonate, or cooking soda) is chemically a sodium hydrogen carbonate, prepared by subjecting recrystallized sal soda, or washing soda, to an atmosphere of carbonic acid gas. The only impurities likely to be found are some sulphates and chlorides remaining from the process of manufacture of the sal soda.

### CREAM OF TARTAR, ETC.

The substances used to liberate the carbonic acid gas are practically reduced to two — cream of tartar and acid phosphate of calcium. The first is prepared from imported argols, a substance used by calico printers and dyers. It is the crust which is formed on wine casks in the process of fermentation. In its refined and purified condition it is sold for bread-making. One baking powder manufactory, at least, is said to use only that which has been chemically prepared. The price being from forty to eighty cents a pound, and in times of disturbance of foreign commerce even twice that, cream of tartar is the most liable to be adulterated of all the articles used in cooking.

Terra alba, sulphate of calcium, or, as it is commonly called, gypsum, is the substance most frequently used to make up 10 to 90 per cent of the weight of cream of tartar. It is reported that fine bone ash has been found in some samples from the Western States. In Eastern Massachusetts the most frequent

adulterant is the much cheaper acid phosphate of calcium; and since this is itself used as a substitute for cream of tartar, the effect on the bread is not as much to be feared as if gypsum were used. If it shall be proved that a certain amount of potassium salts is desirable to counteract the excessive use of salt and salted foods, the much discussed cream of tartar bread may find its place as a recognized article of diet.

Acid phosphate of calcium is prepared from bones by treating them with sulphuric acid, setting free a portion of the phosphoric acid. It is supposed to be a useful ingredient of bread, since it restores some of the phosphate said to be lost in the bran.

Acid lactate of calcium is used for a cream of tartar substitute, and in many respects it promises well. It contains the same acid as sour milk, and is prepared from starch by the action of the lactic ferment.

### BAKING POWDERS

Baking powders, prepared from soda and cream of tartar chiefly, are, when put up in tin cans with the maker's name on the label, much more reliable than any other form of bread-raising preparation. Sometimes a very little bicarbonate of ammonia is added to secure a complete neutralization of the acid without leaving an excess of soda. If this amount does not exceed 1 per cent it can do no harm. As they are made in large quantities they are of a more even composition than when cooks guess at the proportions by spoonfuls. The chief adulterant used is starch or

rice flour, sometimes to the extent of 50 per cent. There is not so much adulteration as has often been supposed, if the articles are purchased of the large firms and of reliable dealers. Alum is not infrequently found in powders sold in bulk. The following simple tests may be of use to those who have had a little practice in chemistry.

Good cream of tartar is soluble in eighteen parts of boiling water. Good baking powder is also soluble; a small quantity of starch present will give a certain opacity to the solution, but if in excess a paste may be formed stiff enough for laundry use. If there is in either case much residue insoluble in water which dissolves in hydrochloric acid, phosphate or sulphate of calcium is to be suspected.

A few drops of barium chloride added to the hydrochloric acid solution will cause a white precipitate if sulphates are present in the substance under examination. If the phosphates are to be tested for, the acid to be used for a solution is nitric, and to the solution a few cubic centimeters of molybdate of ammonia are added. A fine yellow color or precipitate indicates phosphates. Ammonia is sometimes found in baking powders. If present, a small lump of potassium hydrate added to the strong aqueous solution will, on heating, cause the ammonia to be given off in the steam, which will then turn red litmus paper blue.

To test for alum prepare a fresh decoction of logwood; add a few drops to the solution or substance, and render it acid by acetic acid. A yellow color proves the absence of alum; a purplish red or a bluish

color, more or less decided, means more or less alum. If the substance were not acidified the test might be vitiated by the presence of an alkali, as in the case of a baking powder. Caution: Use a new solution, or a new portion of an old one, for each test.

To judge of the quantity of any of the substances it is necessary to have a standard article with which to compare the suspected one. If the same quantity of each is taken, and it is subjected to the same tests, a very correct judgment of its quality may be formed. Acids should be used in glass or china vessels only.

# CHAPTER XIII

## RECAPITULATION

GOOD FOOD FOR LITTLE MONEY means those materials which may be sown, gathered, and prepared largely by machinery, or those which, growing abundantly in distant lands, are dry and hard, and may be transported without serious loss and kept in ordinary storage. All such materials are too abundant and of too low cost by the pound to be subjected to substitution or adulteration. Wise providers make these the chief articles of diet.

GOOD FOODS COSTING MORE MONEY are such as are perishable because of high water content, making a satisfactory food for the ever present micro-organisms of decay. The transportation of so much water (80 to 90 per cent in fruits, 75 per cent in meats) and the need of cold storage add to the original cost, also to the inevitable waste, because of the soft character and frequent accidents in transportation causing delay and the risks of storage. Such foods grown out of season are those of which the supply for the market of the world is limited, of which there are "not enough to go around." There is a temptation to use preservatives with this class of foods. All these should be scrutinized carefully and used sparingly if the pennies must be counted in the week's accounts.

EXPENSIVE FOODS, reckoned by the pound, are those valued for some special reason; imported from the tropics; or without competition in the market. Certain of these lend themselves to adulteration or sophistication or to both, as mustard, cinnamon, vanilla, and lemon extracts, etc. The ready manufacture of artificial flavors and colors adds to the probability of this practice. The remedy is a knowledge of the pure article; then the others will have no attractions.

NUTRITIOUS FOODS are those that contain considerable amounts of either or all of the three chief constituents of human food:

Carbohydrates (starch, sugar, gums, etc.).

Fats and oils (meat fat, nuts, olive oil, etc.).

Nitrogenous substances (albumen, gluten, casein, etc, found in meat, eggs, cheese, peas, peanuts).

FOODS VALUABLE FOR QUALITY RATHER THAN QUANTITY OF CONSTITUENTS:

Fruits for acids and potassium.

Vegetables for essential oils (onions, cabbage) and potassium salts.

Coffee for flavor and exhilarating effect.

Tea.

Such gastronomic qualities are widely imitated and frauds are to be looked for.

FOODS THAT MAY BECOME DANGEROUS:

Liable to putrefactive decay with production of toxins (meats and milk).

Liable to harbor germs in quantity (berries and vegetables exposed to street dust, hence to some disease-giving organisms).

Liable to carry animal or vegetable organisms, because of mode of cultivation (as lettuce fertilized with night soil); or because of handling (ice cream stirred by unwashed hands, ice drawn over sputum-covered sidewalks.)

UNWHOLESOME FOODS:

By nature:

Green fruits.
Strawberries for some people.
Potato skins.
Over-ripe fruits harboring worms.

By preparation:

Too salt, too sweet, too dry.

By storage:

Too long.
Tainted before preparation.
Diseased.
Contaminated by dirt.

FOODS SAFE AND WHOLESOME BY THEMSELVES, but liable to superficial contamination by exposure and handling:

Bread, etc.
Berries.
Vegetables.
Meats.

SOPHISTICATED FOODS, a drain on the pocketbook:

Coffee containing peas and wheat.
Mustard containing starch.
Candy containing glucose and dextrin starch paste.

ADULTERATED FOODS — more or less harmful:

Milk containing formaldehyde.

Dirty or watered milk.

Jellies and fruit extracts containing coal tar dyes (in excess) or benzoic acid.

Cereal coffee containing real coffee.

EXTENT OF ADULTERATION. It is clear that the great bulk of the staple articles of daily diet are of excellent quality, with the one exception of milk, and that is now in a fair way to be much improved. Examine any of the published lists of the state chemist. The names of staple foods other than milk are rarely found. For the tons of flour and sugar and vegetables and fruits used, the alarmist is able to make a collection of a few ounces of spices, catsups, and flavoring extracts, and to run up the numbers of these samples into hundreds. There is hardly a necessary article among them. It is only a depraved taste which requires green candy, pink gelatin, and yellow icing.

SOPHISTICATION. The moral question is far more serious. It is degrading alike to producer and consumer to make and to buy things which are not what they claim to be. To trade upon the ignorance and superstition of the mass of the people is the lowest form of money greed. The quickest remedy for this is education, and the quickest means of educating the public is through the introduction of courses in domestic economy in the public schools. Once it was held to be necessary to read and write and cipher in order to be a valuable citizen of the state. To that we must now add a course in marketing in the broad sense, in spending wisely. The public must protect itself from its enemies from within as well as from without. To

realize how far-reaching this one element of sophistication has gone, it is only necessary to consider recognized conditions. The cost of living has risen some forty per cent within a few years. During that time the market has sold:

| | | |
|---|---|---|
| $.025 | worth of grain | at $.25 |
| .05 | worth of sugar | at .60 to .80 |
| .001 | worth of fruit juice | at .05 a glass |
| .02 | worth of starch | at .20, as candy |
| .01 | worth of lemon oil | at .25, for extract |

HOUSEWIFE'S DUTY. Look over your own household bills and see what part these things play in the year's expense, take to heart the counsel of your state authorities, and put your work where it will tell on the care of the perishable materials exposed for sale. Then see that there are cooking classes which teach these principles. The manufacturers and the writers in the newspapers and magazines have much to answer for, if the coal tar colors are harmful, for they have fostered pink teas and orange luncheons, which can be harmoniously arranged only through these dyes. The great American people have the remedy in their own hands. If they will buy intelligently, with the purpose of securing nutritious food and not decorative material, if they will keep to the staple articles and not be led by the will-o'-the-wisp of skillful advertising (we should be ashamed to be taken in by such bare-faced statements), they will save money and increase national prosperity by a higher degree of health, which will give more real enjoyment than is now momentarily

obtained by the consumption of these highly rated, sophisticated goods.

THE ETHICAL SIDE. This would not have mattered so much if the taste of the wage-earner had not been brought to like these gaudy things, if he had not been made to believe that they were necessary to self-respecting living. He naturally wishes to have all that any one has, and he is made to think that these are desirable things. The fact is that *intelligent* consumers do not suffer from these frauds, either in stomach or in pocket. The great remedy for the oppressive increase in the cost of living is to educate the mass of the people in actual economic values and to make the most stringent laws to protect them from unclean handling of food. The crusade for clean milk must be followed by as vigorous a struggle for protected window displays by ordering all food off the streets, and again by education as to the necessity for these regulations, for the greatest danger to health is found in these directions.

Professor Willard, summing up the question in the Bulletin of the Kansas State Board of Health for June, 1906, says:

"There can be little doubt that in the case of most preservatives, if not all, their presence interferes with digestive processes. Whether more so than results from the use of certain natural, almost unquestioned articles is debatable. If this be the case it would seem that the first and most strenuous efforts in food control should be directed toward securing correct branding. The label should show what preservatives,

if any, are used and the quantities. An individual would then be free to use the article or not, just as he may partake of raw onions or leave them alone. With the conscious use of articles containing preservatives a fund of knowledge on the part of the public would be accumulated which would serve as a basis for legislation based on general experience. This might result in the complete prohibition of certain preservatives, while others would be permitted under proper restrictions.

"In respect to adulterations the problem to the writer seems simpler. An adulteration has but one purpose — that is, of passing off an article of a quality inferior to that which the consumer supposes it to be. Such deception should be repressed without mercy. Akin to this, though not identical, is the sale of pure goods of inferior, representing them to be of first, quality. Against such frauds perhaps we will have to set the common sense and experience of buyers."

It is not without interest to compare the results obtained in one of the earliest state surveys, by the author, at the request of the State Board of Health of Massachusetts in 1878–79. These results were the foundation of the first edition of this book.

The author and her assistants personally visited the chief towns and purchased the samples, choosing those which seemed from local experience most likely to be below standard. It must be remembered that the number of brands was at that date very limited. There were only half a dozen manufacturers of spices, for instance, and only a few sugar refineries contributed

to the grocers' list. Chemistry had not then been impressed into the service of the manufacturer to the extent that it is at present.

It was found that of 400 samples, purchased from 141 dealers in forty towns, 284, or 71 per cent, were good and 29 per cent adulterated (chiefly cream of tartar and baking powder). This was before the day of the coal tar coloring.

At a later date spices were examined, with the following showing: Twelve samples of cinnamon examined, *all* adulterated, only three containing any cinnamon at all. Cassia, powdered wood, and mahogany sawdust were found.

Of thirty-two mustards examined, twenty-seven were adulterated, two only slightly. Only five were good. Starch, Indian meal, turmeric, ground rape seed, and turnip seed were found.

Sixteen samples of pepper were examined. Thirteen were adulterated with ground rice, mustard husks, coarse pepper husks, and *dirt*.

Twenty-eight samples of ginger, on the other hand, showed twenty-one good and only seven adulterated with starch, turmeric, and mustard husks.

That laws do restrain manufacturers from adulterating their goods is proved by over twenty years of experience in Massachusetts. Laws were first passed in 1882. The State Board of Health's report in 1883 shows the situation before the effect of the new law had been felt. Then the percentage of milk adulteration was 83.9; in 1890 it was 42.6; and in 1900, 28.9.

Foods other than milk were adulterated in 1883, 31.2; in 1890, 18.6; and in 1900, 14.2. Percentage of drugs adulterated in 1883 was 40.8; in 1890, 18.7; and in 1900, 50.2, the only increase shown.

The final word, therefore, is, first inform yourself, then work for better conditions in the community and nation.

## THE NATIONAL PURE FOOD LAW

Extracts from the text of the national pure food law, passed by Congress on June 29, 1906:—

*An Act for preventing the Manufacture, Sale, or Transportation of Adulterated or Misbranded or Poisonous or Deleterious Foods, Drugs, Medicines, and Liquors, and for regulating Traffic therein, and for Other Purposes.*

. . . . . .

. . . The term "food," as used herein, shall include all articles used for food, drink, confectionery, or condiment by man or other animals, whether simple, mixed, or compound.

Sec. 7. That for the purposes of this Act an article shall be deemed to be adulterated:

. . . . . .

Second. If its strength or purity fall below the professed standard or quality under which it is sold.

In the case of confectionery:

If it contain terra alba, barytes, talc, chrome yellow, or other mineral substance or poisonous color or flavor, or other ingredient deleterious or detrimental to health, or any vinous, malt or spirituous liquor or compound or narcotic drug.

In the case of food:

First. If any substance has been mixed and packed with it so as to reduce or lower or injuriously affect its quality or strength.

Second. If any substance has been substituted wholly or in part for the article.

Third. If any valuable constituent of the article has been wholly or in part abstracted.

Fourth. If it be mixed, colored, powdered, coated, or stained in a manner whereby damage or inferiority is concealed.

Fifth. If it contain any added poisonous or other added

deleterious ingredient which may render such article injurious to health: Provided, That when in the preparation of food products for shipment they are preserved by an external application applied in such manner that the preservative is necessarily removed mechanically, or by maceration in water, or otherwise, and directions for the removal of said preservative shall be printed on the covering or the package, the provisions of this Act shall be construed as applying only when said products are ready for consumption.

Sixth. If it consists in whole or in part of a filthy, decomposed, or putrid animal or vegetable substance, or any portion of an animal unfit for food, whether manufactured or not, or if it is the product of a diseased animal, or one that has died otherwise than by slaughter.

Sec. 8. That the term "misbranded," as used herein, shall apply to all drugs, or articles of food, or articles which enter into the composition of food, the package or label of which shall bear any statement, design or device regarding such article, or the ingredients or substances contained therein, which shall be false or misleading in any particular, and to any food or drug product which is falsely branded as to the State, Territory, or country in which it is manufactured or produced.

. . . . . .

First. If it be an imitation of or offered for sale under the distinctive name of another article.

Second. If it be labeled or branded so as to deceive or mislead the purchaser, or purport to be a foreign product when not so, or if the contents of the package as originally put up shall have been removed in whole or in part and other contents shall have been placed in such package, or if it fail to bear a statement on the label of the quantity or proportion of any morphine, opium, cocaine, heroin, alpha or beta eucaine, chloroform, cannabis indica, chloral hydrate, or acetanilide, or any derivative or preparation of any of such substances contained therein.

Third. If in package form, and the contents are stated in terms of weight or measure, they are not plainly and correctly stated on the outside of the package.

Fourth. If the package containing it or its label shall bear any statement, design, or device regarding the ingredients or the substances contained therein, which statement, design, or device shall be false or misleading in any particular: Provided, That an article of food which does not contain any added poisonous or deleterious ingredients shall not be deemed to be adulterated or misbranded in the following cases:

First. In the case of mixtures or compounds which may be now or from time to time hereafter known as articles of food, under their own distinctive names, and not an imitation of or offered for sale under the distinctive name of another article, if the name be accompanied on the same label or brand with a statement of the place where said article has been manufactured or produced.

Second. In the case of articles labeled, branded, or tagged so as to plainly indicate that they are compounds, imitations or blends, and the word "compound," "imitation," or "blend," as the case may be, is plainly stated on the package in which it is offered for sale: Provided, That the term blend as used herein shall be construed to mean a mixture of like substances, not excluding harmless coloring or flavoring ingredients used for the purpose of coloring and flavoring only: And provided further, That nothing in this Act shall be construed as requiring or compelling proprietors or manufacturers of proprietary foods which contain no unwholesome added ingredient to disclose their trade formulas, except in so far as the provisions of this Act may require to secure freedom from adulteration or misbranding.

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